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ABSTRACT

Monitoring the Future is an ongoing program of research intended to assess the changing lifestyles, values, and preferences of American youth. This publication, from the occasional paper series, describes a study that monitors drug use and potential explanatory factors among American secondary school students, college students, and young adults. The study aims to monitor drug use and related factors in order to provide social indicators of historical change, to distinguish the three types of change (age, period, cohort), and to analyze results at both individual and aggregate levels. Eleven specific objectives of the study are described and each is explained, including its logic and rationale, relevant theory, literature cited, and progress. Objectives 1 through 3 concern drug use and potential explanatory factors; Objective 4 distinguishes which kinds of change are occurring for various types of drug use; Objectives 5 through 9 study the causes, consequences, and developmental patterns associated with types of change in drug use; and Objectives 10 and 11 list additional methodological, policy, data-sharing, and other objectives. (Contains over 500 references.) (JDM)

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paper 52

THE AIMS AND OBJECTIVES OF THE MONITORING THE FUTURE STUDY AND PROGRESS TOWARD FULFILLING THEM AS OF 2001

Lloyd D. Johnston
Patrick M. O'Malley
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Monitoring the Future: A Continuing Study of the Lifestyles and Values of Youth

As its title suggests, this study is intended to assess the changing lifestyles, values, and preferences of American youth on a continuing basis. Each year since 1975 about 17,000 seniors have participated in the annual survey, which is conducted in some 130 high schools nationwide. In addition, subsamples of seniors from previously participating classes receive follow-up questionnaires by mail each year.

This Occasional Paper Series is intended to disseminate a variety of products from the study, including pre-publication (and somewhat more detailed) versions of journal articles, other substantive articles, and methodological papers.

A full listing of occasional papers and other study reports is available from Monitoring the Future, Institute for Social Research, The University of Michigan, P.O. Box 1248, Ann Arbor, MI 48106.

THE AIMS AND OBJECTIVES OF THE MONITORING THE FUTURE STUDY AND PROGRESS TOWARD FULFILLING THEM AS OF 2001

Monitoring the Future Occasional Paper 52

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INTRODUCTION

Specific Aims of the Project

Monitoring the Future (MTF) is an ongoing program of research designed to accomplish three broad and complementary aims:

(1) To monitor drug use and potential explanatory factors among American secondary school students, college students, other young adults, and selected age groups beyond young adulthood (detailed under Objectives 1 through 3, below).

(2) To distinguish which of three fundamentally different kinds of change—age, period, and/or cohort—are occurring for various types of drug use, including the use of tobacco and alcohol (Objective 4 below).

(3) To study the causes, the consequences, and (where relevant) the developmental patterns associated with these different types of change in drug use (detailed under Objectives 5 through 9, below).

Objectives 10 and 11 list additional methodological, policy, data-sharing, and other objectives.

In pursuit of these three interrelated aims, the project employs a cohort-sequential research design consisting of (a) annual cross-sectional surveys of large, nationally representative samples of high school seniors (beginning with the class of 1975) and eighth and tenth graders (beginning in 1991), and (b) follow-up surveys of each senior class annually through age 30, and at half-decade intervals thereafter.

At present, some 45,000-50,000 secondary school students located in approximately 430 secondary schools are surveyed annually (for example, the 2000 survey had 17,000 eighth graders in 156 schools, 15,000 tenth graders in 145 schools, and 13,000 twelfth graders in 134 schools). In addition, the 2000 follow-up survey of previously graduating classes yielded a young adult sample of about 10,000 respondents in the age range of 19 to 32, which includes about 1,500 young adults one to four years past high school who are actively enrolled in a two- or four-year college and comprise the college student sample.[1] Additional follow-ups are conducted at ages 35 and 40 and are being proposed at five-year intervals thereafter. These several data sets, in addition to a panel survey of three of the eighth-grade cohorts (surveyed as

[1] For an in-depth description of the study's research design, see Bachman, J. G., Johnston, L. D., & O'Malley, P. M. (2001b). *Monitoring the Future project after twenty-seven years: Design and procedures*. Monitoring the Future Occasional Paper No. 54. Ann Arbor, MI: Institute for Social Research. A less detailed description can be found in Johnston, L. D., O'Malley, P. M., & Bachman, J. G. (2001b). *Monitoring the Future national survey results on drug use, 1975-2000*. NIH Publication No. 01-4924. Bethesda, MD: National Institute on Drug Abuse.

eighth graders in 1991-1993), provide the information base with which the multiple aims of the study are being pursued.

The first of the broad aims—monitoring drug use and related factors in order to provide social indicators of historical change, as well as to explain those changes—clearly implies an ongoing effort. The same is true for the second broad aim of distinguishing the three types of change—age, period, and cohort. Although it may be less obvious, the third broad aim—exploring causes, consequences, and developmental patterns—also is an ongoing effort, involving analyses at both individual and aggregate levels. At the aggregate level we continue to document the emergence of new secular (and recently cohort) changes, as well as the emergence of new drugs. At the individual level of analysis, the process is ongoing in part because new developmental stages are being added to the study, and in part because the underlying relational patterns are themselves subject to change (e.g., see Bachman, Johnston, & O'Malley, 1981a, 1989; Bachman, O'Malley, & Johnston, 1986; Johnston, O'Malley, & Bachman, 2001b). Further, new policies and programs are constantly being introduced (e.g., decriminalization, legalization of marijuana use, lowering of the legal blood alcohol level for teen drivers, changes in the minimum drinking age, the parent group movement, national advertising campaigns against drug and cigarette smoking), so having this "social observatory" in place permits a more timely, and often a prospective, assessment of their impacts.

We believe that the multiple aims of the study are interconnected and mutually facilitating. Thus, a substantial efficiency results in addressing them in a single project rather than a number of separate ones, and in some important ways, the total product is greater than would be possible under a more fractionated approach.

Overview of the Eleven Objectives

To provide an overview, the eleven specific objectives of the study are listed below without commentary. Then, after a section on the theoretical background and conceptual framework which gave rise to the many variables included in the study, each of the eleven objectives will be discussed separately. Each will be explained more fully, its logic and rationale presented, relevant theory and literature (sometimes an extensive literature) cited, and the study's progress on each briefly summarized.

Objective 1: To continue monitoring a broad range of drug-related behaviors, as well as explanators of change—including attitudes, beliefs, and perceptions—across nationally representative samples of eighth, tenth, and twelfth grade students. This annual monitoring began in 1975 for twelfth grade students, and in 1991 for eighth and tenth grade students. The specific characteristics to be monitored are:

a. Self-reported use of over 40 classes and subclasses of drugs, both licit and illicit. (Listed in Table 1.)
b. Patterns of initiation of use and noncontinuation of use.
c. Patterns of multiple drug use, both concurrent and non-concurrent.
d. Beliefs about the harmfulness of various types of drugs at various levels of use.
e. Personal disapproval of various types of drugs at various levels of use.
f. Perceptions of disapproval by peers of the use of various drugs (i.e., perceived peer norms).

g. Beliefs (or stereotypes) regarding cigarette smokers and frequent marijuana users.
h. Extent of direct exposure to use of various drugs, and proportions of friends using various drugs.
i. Perceived availability of the various drugs.
j. Contexts in which drugs are used (when, where, and with whom).
k. Personal reasons for use of the various drugs, for abstention, and for discontinuation.

Objective 2: To continue to monitor and study these same drug-using behaviors and potential explanatory variables among nationally representative samples of young adult high school graduates (modal ages 19 - 30), including nationally representative samples of American college students.

Objective 3: To monitor and study longer-term patterns and consequences of drug use beyond young adulthood by continuing to conduct follow-up surveys at ages 35 and 40, and by adding age 45.

Objective 4: To attempt to distinguish among three basic types of change in drug use and related factors at the aggregate level: age, period, and cohort.[2]

Objective 5: To attempt to explain, at the aggregate level of analysis, secular trends and lasting cohort differences in drug use, emphasizing changes in cultural influences, attitudes, beliefs, value orientations, price, and availability as possible explanators.

Objective 6: To examine at the individual level of analysis the natural history of drug use and related factors from early adolescence through middle adulthood, and to attempt to explain age and social role effects on the initiation, maintenance, and cessation of drug use.

a. To assess during the *secondary school* years the impact of individual characteristics (e.g., values, beliefs, lifestyles, and other behaviors such as delinquency, school performance, and religiosity) and social environments (e.g., part-time work, sports and other extracurricular activities, activities outside of school, peer groups) on drug use and related factors, with particular emphasis on the specification of risk and protective factors.
b. To assess during the *post-high school* years the impact of individual characteristics, major social environments (e.g., college, military service, civilian employment, homemaking, unemployment), and roles (e.g., marriage, pregnancy, parenthood, divorce) on drug use and related variables.

Objective 7: To assess both the short and longer-term consequences of various types of drug use—particularly heavy use—on a number of outcomes in the domains of physical and psychological health, status attainment, role performance, family and social relations, driving performance, deviant behavior, etc.

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[2]Age effects are consistent changes with age observed across different birth cohorts (or in this case, across graduating class cohorts). Period effects are consistent changes over an historical period observed across various age groups. Cohort effects are enduring differences among cohorts compared at equivalent ages.

Objective 8: To give special emphasis throughout to the more frequent or heavier users of the different drugs, i.e., individuals most likely to be characterized as "abusers." (This objective crosscuts most of those above.)

Objective 9: To continue to study drug use and drug-related attitudes and beliefs among a number of subgroups historically under-represented in drug abuse research. These include women, ethnic minorities, and young adults who do not attend college, as well as those in military service, civilian employment, or homemaking after high school. (This objective also crosscuts those above.)

Objective 10: To continue to make methodological, substantive, and policy-relevant contributions to the larger fields of social, behavioral, educational, and medical research dealing with drugs and/or youth.

a. To refine methodologies for the analysis and interpretation of self-report measures of drug use, including documenting the reliability and validity of such measures.
b. To continue to provide measures for, and stimulate comparability of measurement in, drug research at the local, state, national, and international levels; and to provide national norms for comparison.
c. To continue to conduct research of policy and program importance, particularly the evaluation of "natural experiments" that can build upon the main study with great economies in cost and time; and to facilitate the use of MTF data for policy studies by and with external collaborators, who often combine MTF data with other relevant data sets.
d. To continue to provide measures of progress toward the accomplishment of various national goals, including the National Education Goals, the National Health Goals, the President's National Drug Control Strategy goals, the DHHS reports on child well-being, the Surgeon General's Reports on Smoking, and the Surgeon General's Reports on adolescent violence.

Objective 11: To continue to facilitate the use of the MTF databases by others—including investigators in a variety of substantive and disciplinary fields—while adequately protecting the confidentiality of the study's many respondents.

Even this comprehensive listing of objectives does not provide a complete enumeration of the questions and hypotheses that the study can be used to address, or has addressed already. These are spelled out in much greater detail below under a separate discussion of each objective.

Part 1

THEORETICAL BACKGROUND AND CONCEPTUAL FRAMEWORK

In 1980, Lettieri, Sayers, and Pearson edited a volume presenting fully 43 different theoretical perspectives on drug use, and since then there has continued to be a great deal of development of new and existing theoretical approaches (for example, see Akers & Cochran, 1985; Baumrind & Moselle, 1985; Brook, Brook, Gordon, Whiteman, & Cohen, 1990; Catalano, Kosterman, Hawkins, & Newcomb, 1996; Donovan, Jessor, & Costa, 1991; Donvan, 1996; Elliott, Huizinga, & Ageton, 1985; Elliott, Huizinga, & Menard, 1989; Flay & Petraitis, 1994; Hawkins, Lishner, Catalano, & Howard, 1986b; Herting, Eggert, & Thompson, 1996; Johnston, 1991a; Kandel, 1998; Kaplan, 1985; Kumpfer & Turner, 1990; Lonczak et al., 2001; Marcos, Bahr, & Johnson, 1986; Massey & Krohn, 1986; Newcomb, 1997; Newcomb & Bentler, 1988; Newcomb & Earleywine, 1996; Oetting & Beauvais, 1987; Rhodes & Jason, 1990; Schulenberg & Maggs, in press; Szapocznik & Coatsworth, 1999; Tarter & Mezzich, 1992; Zucker, 1989).[3] The various perspectives run a wide gamut in terms of (a) the classes of substances encompassed (e.g., heroin only, alcohol only, any illicit substance, etc.), (b) the stage of involvement being explained (e.g., initiation, continuation, transition to "abuse," cessation, or relapse), (c) the classes of determinants under consideration (e.g., social, psychological, physiological, etc.), (d) the more general theory of human behavior, if any, upon which the specific drug use theory is grounded (e.g., psychoanalytic, behavioral, social field, social learning, etc.) and (e) the level at which the phenomenon to be explained is measured (e.g., levels of use at the individual, institutional, or societal level). Yet in spite of—or perhaps in part because of—this breadth and diversity of theorizing in the drug field, the research in this area has long been described as mostly atheoretical (Kandel, 1980; Radosevich, Lanza-Kaduce, Akers, & Krohn, 1980). This is not actually so surprising, considering that theories in this area—particularly social-psychological theories—are still very much "in process." Although there have been some efforts made toward developing fairly general theories (Kaplan, et al., 1982, 1986, 1987; and Jessor & Jessor, 1977, to cite just two examples), most of these theoretical perspectives are still rather limited in scope, and are what Merton called "theories of the middle range, theories intermediate to the minor working hypotheses evolved in abundance during day-to-day routines of research, and the all-inclusive speculations comprising a master conceptual scheme." Such theories consist of a "general orientation toward data, suggesting types of variables which need somehow to be taken into account, rather than clear, verifiable statements of relationships between specified variables" (Merton, 1957, pp. 5, 9). Writing much later, Petraitis, Flay, and Miller (1995) commented that "... as social scientists we might be aware of many (if not most) of the constructs that contribute to [adolescent substance use], but we do not yet know how all these constructs ... fit together." (p. 67)

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[3] The word "theory" is used rather loosely here, as is common practice in this field; we take a broad-based view of the term and recognize that its meaning can range from conceptual frameworks to elaborated and specific systems of testable hypotheses.

We certainly regard the theoretical approach that has guided much of the development of our work to be middle-range; *and* it is eclectic, since we did not feel that any single extant theoretical approach was sufficiently comprehensive and specified to serve as the sole basis for selecting measurement and guiding analysis in this large and ongoing study. The fact that MTF has the multiple objectives described here makes it particularly impractical to take a single theoretical stance. Our theorizing provided a general approach for generating hypotheses, conceptualizing the measures, and organizing many analyses. There are a great many hypotheses implied in our conceptual framework, described later; but there are many more we had in mind at the outset and that we have added over the life of the study. Thus our approach to theory, like most others mentioned here, has actually been an evolving process in which further elaboration and specification have occurred and are to be expected in the future. It is an iterative process, in that the theoretical framework leads to some empirical tests, which in turn yield some revisions and/or elaborations of the framework. This process is consistent with what Cattell (1966) described as the "inductive-hypothetico-deductive spiral."

In the present study a theoretical structure has been evolving to provide explanation of trends in drug use at the societal or *aggregate* level. Building upon a set of measures of perceived risk, disapproval, and peer norms, which were included in the study from the start (Johnston & Bachman, 1980), we have tested our hypothesis that these are important determinants of changes in drug use. When marijuana use began to decline after peaking around 1979, we described changes in perceived risk as a likely determinant because of its correlated upturn (Johnston, 1982; Johnston, Bachman, & O'Malley, 1981). More evidence was presented from the reasons quitters and abstainers gave for their not using marijuana and in the trends in the frequency with which they gave these reasons (Johnston, 1982, 1985). We also advanced at that time the hypothesis that changes in perceived risk may be helping to drive changes in disapproval of use (and, derivatively, in peer norms). Trends in both marijuana use and those attitudes and beliefs continued to evolve in the predicted way throughout the 1980s and 1990s, giving additional evidence to the theoretical position. Further, evidence on one major competing hypothesis—that changes in availability were driving the downturn—did not receive empirical support (Johnston, O'Malley, & Bachman, 1989). Another alternative hypothesis was offered by Jessor (1985)—that a shift in young people toward a more conservative lifestyle could have caused the downturn—was addressed and found inadequate (Bachman, Johnston, O'Malley, & Humphrey, 1988). The latter article also demonstrated that if one looked separately at trends across high school classes within each level of perceived risk, no downturn in use occurred, but rather some increased. (A subsequent article dealing with the same issues with regard to the downturn in cocaine use leads to much the same conclusions [Bachman, Johnston, & O'Malley, 1990a].) More recently, as marijuana use again rose, changes in both the perceived risk and disapproval proved to be leading indicators of the turnaround in use (Bachman et al., 1998; Johnston et al., 2001b). Based on our original set of hypotheses, the confirmation of a number of those over a number of years, and other correlated evidence, we offered a first statement of a fairly comprehensive theory of the spread, maintenance, and contraction of drug epidemics (Johnston, 1991a). Subsequently, the country entered what we have characterized as a "relapse phase," for which further theoretical formulations were added for an expansion of the theory. See Johnston, O'Malley, and Bachman, (2001b and earlier volumes in this series) for a discussion of the roles of "generational replacement" and "generational forgetting," as well as other factors at the societal level.

At the *individual* level of analysis and explanation, there certainly has been much progress toward cataloguing the multitude of influences on drug use and attempting to place them within a coherent conceptual framework (e.g., Glantz & Hartel, 1999; Hawkins et al., 1992; Pandina & Johnson, 1999; Petraitis et al., 1995; Schulenberg & Maggs, in press; Szapocznik & Coatsworth, 1999), but it is fair to say that there is not as yet a comprehensive theory to deal with all aspects of drug use. We are not unduly discomforted by this fact; nor are we especially uneasy about taking a somewhat eclectic (though certainly not arbitrary) approach to the development of our measurement and analysis. Three decades ago, Dudley Duncan, in discussing next steps in social reporting, wrote at some length about the "theorist" versus the "inductivist." His comments are sufficiently fundamental to theory in the drug area, and particularly to our own approach, that we quote them here.

> . . . It is a rare body of theory in the social sciences (and perhaps even in the natural sciences) that is sufficiently complete and detailed to specify exactly how to accomplish the relevant measurement. On the contrary, many quantities now considered to be well-measured became so only as a result of a long process of trial and error, leading to an evolution of the measurement technique, and ultimately a standardization of it. . .
>
> It can hardly be the case that any serious effort at measurement is undertaken on the basis of a theoretical tabula rasa. . . A fortiori, a social scientist steeped in the conceptual framework of his discipline could not, even if he wanted to, undertake a job of measurement without its being affected by some set of ideas. . . of how the quantity to be measured relates to other variables of interest. . .
>
> . . . But to the degree that one sees a body of understanding as a crescive structure with ragged edges in the neighborhood of recent increments, one should expect the . . . "theoretical" quality of a collection of measurements to emerge pari passu with the growth of the measurements themselves. (Duncan, 1969, pp. 8-9)

In our view, this describes much of what has been happening in the drug field in recent decades. There has been a good deal of measurement (some more theoretically guided, some less so) as well as a good deal of relational analysis; and this activity has contributed importantly to the further development and refinement of theory. We see our own research, both that which has been completed and that proposed, as providing valuable ingredients for this ongoing process as we and others continue gradually to advance theory relating to drug use (some of our recent work in terms of advancing a developmental perspective—e.g., Schulenberg & Maggs, in press—is described later when considering Objective 6). But, to repeat the point, we did not think it appropriate to have premised such a large and ongoing research endeavor, with its many varied research purposes, on any single theoretical position.

Domain of Variables and General Theoretical Grounding

Our approach to theory is at the broadest level social-psychological, in that nearly all determinants under consideration are social or psychological characteristics of the person, or characteristics of his or her social environment. (Thus, we omit several domains of undoubted importance: in particular, genetic, biological, and physiological.) The general theoretical approach to human behavior which we have brought to the selection and analysis of variables

has its roots in Lewinian field theory, which also underlay our previous work on the Youth in Transition Study (Bachman et al., 1967; Johnston, 1973), and which, incidentally, underlies the theoretical perspectives of others in the drug field, such as Jessor and Jessor (1977). The three major components of Lewinian theory are the person, the environment, and behavior; additionally, a distinction is made between the perceived environment and the actual environment (Deutsch, 1968).

Within the theory, it is the subjective perceptions of the environment (e.g., perceived peer disapproval of drug use) which are considered critical in determining the motivation and intention to act. In the present study, nearly all measures of the environment are of this type (though aggregating answers of students in school does provide a more objective measure of aspects of the environment which can be commonly observed).[4] The "person" refers to the psychological characteristics of the individual (attitudes, values, beliefs, and perceptions) as well as to directly observable characteristics. Certainly the central contribution of Lewinian field theory was the emphasis it placed on the environment, and on the interdependence between characteristics of the person and characteristics of the environment in determining behavior.

The Basic Conceptual Framework

In its most rudimentary form, the model contains three elements: (1) the focal behavior to be explained, (2) characteristics of the person (including all other behavior), and (3) characteristics of the social environment. All three elements are posited to influence all others, and characteristics of the person and the environment are posited to have interactive effects on the focal behavior. This basic model is presented schematically in Figure 1.

For the sake of brevity, we will leave the "focal behavior" broadly stated in the following discussions. It should be noted, however, that in this study we include as eligible for this status the use of (or changes in use of) any of the substances under study (defined by period prevalence, frequency, quantity, or some combination of these); use (or changes in use) of empirically defined constellations of these drugs; and/or stage transitions in one or more of the indexes of drug involvement, discussed under Objective 1b. We find it useful for heuristic purposes, however, to segment and elaborate portions of the other two elements in the model—the person and the social environment.

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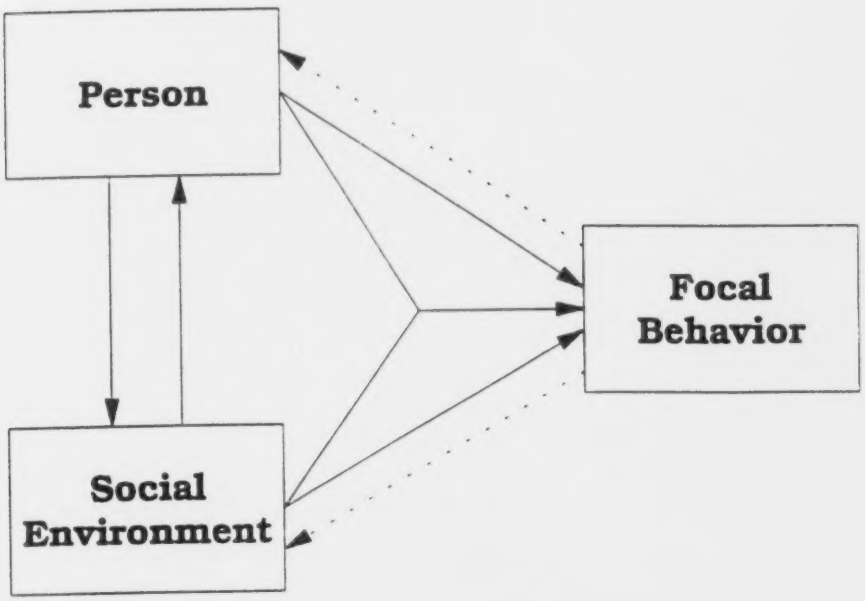
[4] While recognizing the potential for discrepancies between the "objective environment" and the "subjective environment" as perceived by the person, we have not chosen to focus on the measurement of those discrepancies (which would have required an even more elaborate research design involving data collection from direct observation, significant others, and/or archival records), nor do we here theorize about the importance of them. For many of our measures of social environment, there should be relatively little discrepancy due to unconscious distortion or misperception (e.g., presence of family members in household, enrollment as a student or holding a paid job on a particular date, the size of the high school or college, etc.). Some measures of perceived attitudes of significant others (e.g., status ascribed to particular behaviors by students in the school) can be checked against aggregate data from those students. An important example exists in our comparing perceived norms regarding drug use with the aggregated self-reported attitudes of peers: our conclusion that there often is a "collective ignorance" about others' attitudes is a case of looking at the discrepancy between objective and subjective environments. However, for some measures (such as friends' or parents' expectations of the respondent) we rely on the subjective reality reported by the respondent.

Figure 1.
Basic Elements in the Theoretical Framework



First, there is a class of person characteristics which cannot accurately be said to be influenced by the other elements in the model, namely, family background and ascriptive characteristics. Further, since nearly all of these come prior to, and have important effects on, a number of the other characteristics of the person, the family background and ascriptive characteristics have been placed earlier in the causal sequence. Figure 2 shows this placement, as well as some other elaborations of the model which are discussed in the next paragraphs.

The social environment has been segmented into two very broad domains: the proximal domain, including those aspects of the environment with which the subject interacts directly and in person; and the distal domain, including those aspects which are more distant and mediated through the media, books, and other sociocultural influences. The current study contains a rather modest amount of measurement relative to the latter aspects of the social environment, so we enclose this box with a dashed line. (We have, however, added questions about exposure to anti-drug ads and anti-smoking ads in the media, and about perceived drug and cigarette use and related attitudes among public role model groups.) We chose to include the distal social environment here explicitly to illustrate that we view such sociocultural influences as extremely important, particularly for explaining changes in behavior at the aggregate level (see Johnston, 1991a). Like the ascriptive characteristics, this class of variables has no reciprocal causation posited to affect it. The characteristics of the larger society are presumed to influence characteristics of the person's immediate social environment, as well as the person's own behavioral and personality characteristics directly. They are posited to affect a person's role status indirectly through these other elements.

A third class of variables is delineated separately in the framework because it contains elements which are characteristics of both the person and his or her social environment. These are the role statuses held by the individual: his or her student status, work status, marital status, parental status, and so forth, as listed in Figure 3. Holding these statuses (and equally importantly, *moving into and out of* these statuses; see e.g., Bachman et al., 2002; Schulenberg & Maggs, in press) is posited as influencing some of the personality and behavioral characteristics of the person; the characteristics of the immediate social environment(s) being experienced by that person; and through them, the focal drug-using behavior. The fact that only one causal arrow leads to "role statuses" in the model (the arrow from behaviors and other person characteristics) can be explained as follows. The act of entering or leaving a role (i.e., a "role transition") is classified with the other behaviors. The influences of the other major elements in the framework on role status (and they are nearly all certainly assumed to affect role status) are mediated through their effect on the role transition behavior. Many family background and ascriptive characteristics, as well as features of the larger social environment, are presumed to influence one's role status via their impact on the person's immediate social environment, which in turn influences his or her role transition behaviors.[5]

[5] Perhaps we should make explicit here that in our actual analyses of data we sometimes examine relationships where there are no arrows shown. Thus, for example, the ascriptive characteristics of parental educational level may relate to role status as a college student or as a high school student in the college preparatory curriculum. We *theorize* that such relationships occur via social environments and role transition behaviors, etc.; nevertheless, we may not have measured such environments and behaviors adequately and thus are not able to represent the hypothesized intervening processes in our analyses.

Figure 2.
Elaboration of the Elements in the Theoretical Framework

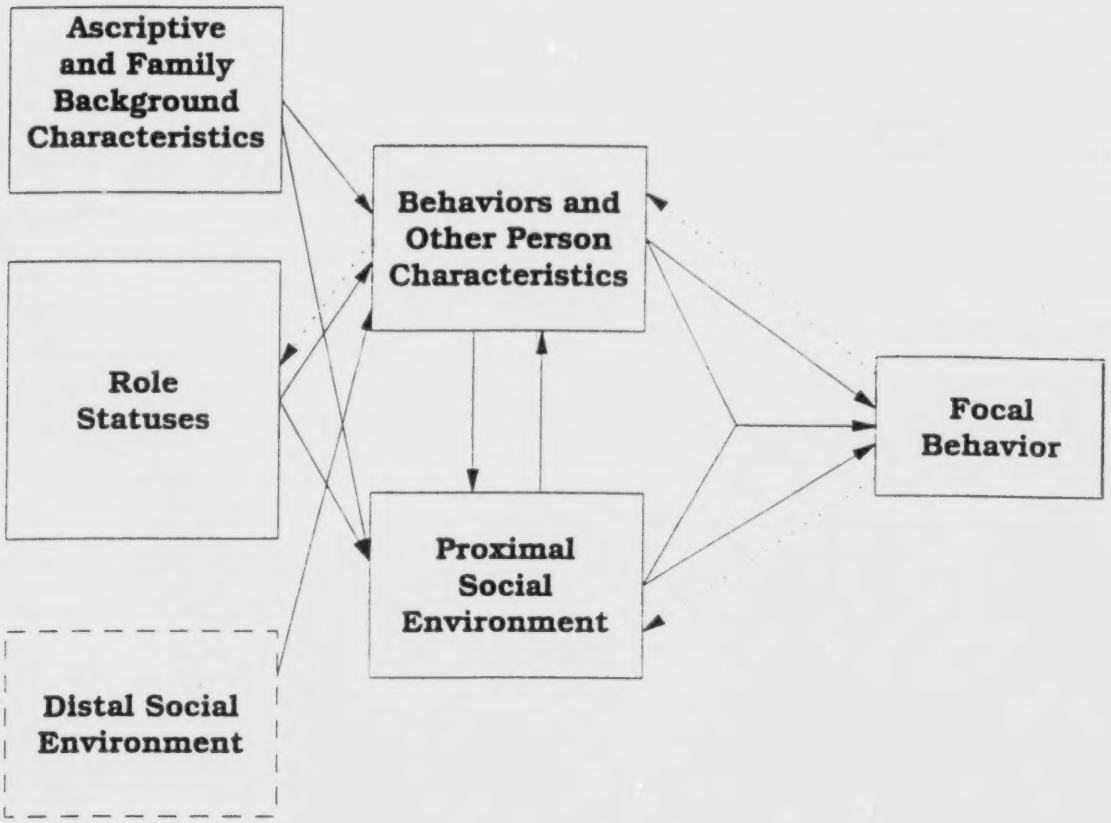
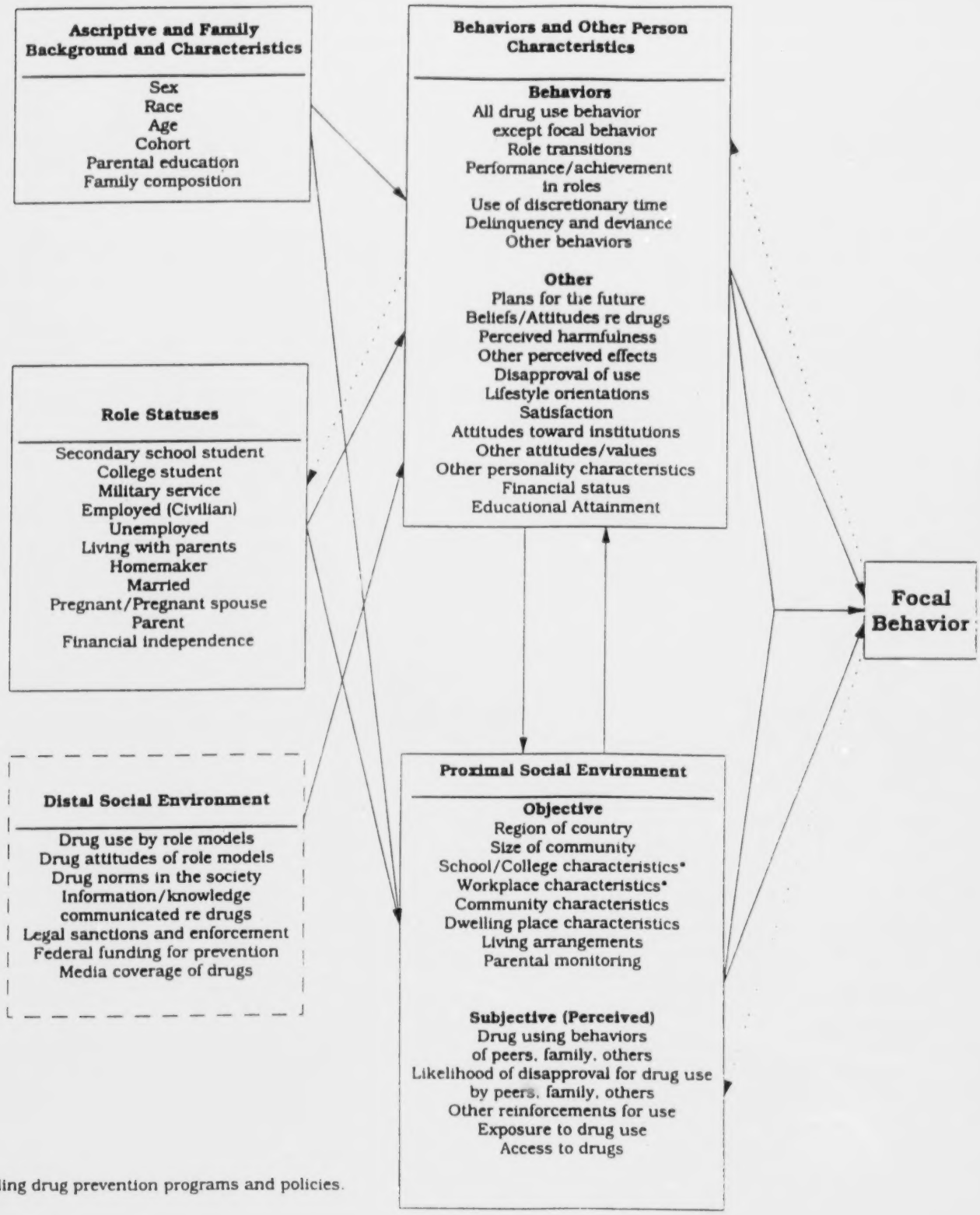


Figure 3.
Further Specification of the Elements in the Theoretical Framework



*including drug prevention programs and policies.

Before expanding on these basic elements in the model, however, we should note that a great deal of additional theoretical discussion is contained in Part II of this occasional paper in the sections dealing with the many objectives of the study. While there is theoretical discussion throughout, the discussion of Objective 6—dealing with risk and protective factors in adolescence and with explaining the changes in substance use in the transition from adolescence—contains a substantial theoretical discussion and explication of the approaches we are taking in our own analyses.

The Immediate Social Environment

Social influence processes. While Lewinian field theory may be thought of as the source of the emphasis we give to subjectively measured characteristics of the social environment, and to person-environment interactions, a number of other theoretical approaches have contributed to our theoretical elaboration within this framework. The selection of particular environmental variables has been guided in substantial part by the social learning theory of Bandura (Bandura, 1977) and others, with its emphasis on modeling and imitation, and by social role theory more generally (e.g., see Sarbin & Allen, 1968; Simons, Conger, & Whitbeck, 1988), with its emphasis on the communication of role expectations. (Stephens, 1985, provides an example of an earlier theoretical approach to drug addiction that is explicitly role-theoretic.)

We believe that the social expectations of others in the subject's immediate environment—particularly peers—and the models they provide, comprise an important set of determinants (social influences) for the various types of drug-using behavior under investigation. (For further discussion, see Objectives 1f and 1h). Thus, quite a number of measures having to do with modeling and role expectations in the immediate social environment are included in this study, most of them addressed to more immediate elements—that is, to people with whom the subject interacts in person. However, we also believe that important role expectations and models are presented through the media and other more remote elements in the social environment. (This emphasis on the larger social environment is consistent with the contextual approach that has been advocated by, for example, Biglan et al.,1990). We have added some measurements in this domain in more recent years, and we continue to consider external measures of what we hypothesize to be important variables in the larger (distal) social environment in our search for the causes of changes in aggregate levels of drug use—such variables as levels of cigarette advertising and promotional expenditures, media coverage of the anti-drug commercials, levels of media coverage of the drug issue in the news, federal expenditure levels on drug prevention in the schools, and (when they become available) levels of portrayal of smoking and other forms of drug use in the movies and in television entertainment programming. While finding correlated trends between these types of factors and our aggregate levels of drug use is not sufficient to prove causation, it certainly helps to narrow the list of plausible explanations; because in the absence of a correlation (with or without time lag) many potential explanations can be eliminated. It also permits us to adjust the probabilities we can attach to various possible explanations, even if some cannot be eliminated outright.

For each of the elements in the conceptual framework, Figure 3 provides a specification of the general classes of variables which are hypothesized to predict drug use. Under the Immediate Social Environment are listed three classes of variables hypothesized to have their effect on drug use through these social influence processes—namely, the drug-using behaviors of

salient others, the perceived likelihood of their disapproving of the subject using drugs, and the felt pressure from them to use drugs. More specifically, these include the attitudes (or norms) regarding drugs perceived to be held by three particularly salient roles in the subject's immediate social environment: parents, close friends, and the student body in general. Also of hypothesized importance, because of their social influence via modeling and imitation, are the actual drug-using behaviors of these three groups. The proportion of students in the school using drugs can be determined from school aggregate data, while the proportion of close friends using drugs is asked directly of the subject. (Parental use cannot be asked of students, unfortunately, due to practical considerations including the willingness of schools to participate, although we can ask this information of young adults.) It should be noted that we see the effects of these social influence factors on drug use as working in part through their effects on the respondent's own attitudes, beliefs, and perceptions regarding those drugs. We also predict they will have effects that are not mediated by these intervening variables.

Parental monitoring and influence. Another element in the immediate social environment that is particularly relevant to understanding drug use among adolescents is "parental monitoring." This refers both to the amount of time spent in the parental home (presumably under parental influence) and the extent to which students perceive their parents as taking an active role in their lives (e.g., educational pursuits). There are several measures contained in the study which are of direct relevance to this factor including, for example, how many nights per week the young person goes out for fun and recreation, the extent to which parents help with homework (for the eighth and tenth graders), and whether the young person is living in the parental home (for the young adults). (These are discussed in some length in Part 2—especially Objective 6b—of this Occasional Paper.) We judge this factor to be reflective of one of the more important sources of social control for drug use—parental influence or monitoring (see also, e.g., Baumrind, 1985; Brook et al., 1990; Chilcoat & Anthony, 1996; Duncan, et al., 1998; Hawkins, Catalano, & Miller, 1992; Hops, et al, 2000; Murray & Perry, 1985; Steinberg, 1987).

Of course there are other positive and negative reinforcements in the immediate social environment besides the disapproval or approval of parents, friends, and the larger student body. These are represented in the model in the aggregate as other reinforcements for use. (The influences of having a spouse and children are discussed below under "role transitions.")

Availability. Other important environmental determinants built into our theoretical structure are availability and opportunity to use. These derive in part from the "availability proneness theory of illicit drug use" explicated by Smart (1980). (This theory, incidentally, fails to take into account the social influence processes of the type just mentioned.) It emphasizes availability as a major determinant, and availability refers to the set of physical, social, and economic circumstances surrounding the ease or difficulty of obtaining drugs (Smart, 1980, p. 47).

Respondents in Monitoring the Future are asked to rate their access to various drugs, in terms of how difficult it would be for them to get some if they wanted them. (See Objective 1i in Part 2 of this Occasional Paper.) We expect market access to vary from school to school and among the different types of environments entered after high school. The longitudinal panels provide a particularly good opportunity to assess dynamically the strength of the relationships

between access and use. (The effect of price can to some degree be addressed in the reasons given for abstention and quitting by non-users. Externally gathered price information can also be used in conjunction with the study's usage data. Such analyses have now been conducted: see, for example, Grossman et al., 1996a, 1996b; Pacula et al., 2001.)

Our own position is that access is a necessary, but by no means sufficient, condition to cause use. We have argued elsewhere that the other necessary conditions are (1) an awareness of the drug and its alleged psychoactive effects, (2) reassurance about its safety, (3) a willingness to violate the law and/or predominant social norms, and (4) a motivation to use (Johnston, 1991a). The motivation for use may be any of a broad variety, including curiosity, rebellion, social facilitation and/or expression, and psychological coping with negative effects (Johnston & O'Malley, 1986). The evidence presented from the study so far (e.g., Johnston et al., 2001b) supports the notion that use of a specific drug in the aggregate can decline with either little or no change in availability (as in the case with marijuana) or an actual increase in availability (as with the case of cocaine).

Other aspects of the immediate social environment. The immediate social environment is also a function of the region of the country and size of city in which the individual resides, and the particular characteristics of his or her school, workplace, and dwelling place. We therefore expect them to be predictors of the more proximal environmental factors just discussed—that is, of relevant modeling, role expectations, availability, and exposure to use. The characteristics of the school, workplace, and dwelling place in turn are very much a function of the role statuses (or combination of statuses) held by the respondent. (See Objectives 5 and 6 for an elaboration of the measurement content in the above areas, as well as some of the analysis possibilities.)

Person Characteristics

Age and cohort. The effect of age, cohort, and period, singly and in combination, are discussed later in this Occasional Paper under Objective 4. For discussion purposes we focus here on age and cohort (which together define period), though we might just as well have chosen age and period (which together define cohort) or even cohort and period (which together define age). These are ascriptive characteristics of the person which are often forgotten or overlooked in social science but which, as we will document later, are generally very important determinants of behavior—particularly drug-using behaviors.

We hypothesize that the role expectations of others (both parents and peers) and the modeling behavior of others (in particular, peers) will vary according to the age of the respondent and the cohort in which he or she grew up. Obviously illicit drug use would have been viewed by both parents and peers as a more deviant behavior for a teenager in a 1940s or 1950s cohort than it is for a teenager today. Similarly, marijuana use is likely to be more strongly disapproved by both parents and peers for an 8-year-old than an 18-year-old. Others' beliefs about what is age-appropriate behavior, which of course can lead to expectations about appropriate role behavior for oneself, probably also account for the early peaking of inhalant use (Johnston et al., 2001b) and for the sequential nature in which delinquency, drug use, and other problem behaviors emerge (e.g., see Elliott, Huizinga, & Ageton, 1985; Jessor & Jessor, 1977; Kaplan, 1995; Johnston, O'Malley, & Eveland, 1978). It also may help to account for the ages and sequences in which these behaviors tend to extinguish.

Thus, we believe role expectations and modeling effects are a function of the age and the cohort of the respondent. Further, we expect cohort to be predictive of attitudes and beliefs about drugs in ways other than through the role expectations and role modeling of others in the immediate environment; more specifically, we expect them to occur because of changes occurring concurrently in the larger culture (e.g., in the role modeling, norms, and social expectations transmitted through the media). Johnston (1991a) has argued that modeling and communication of role expectations regarding drug use by older cohorts to younger ones is one of the important mechanisms by which the forward momentum of an epidemic is maintained after some of the historical forces that initially gave rise to it (e.g., the counter-culture and anti-war movements) have ceased to exist. While not explicit in our graphical presentations, we obviously expect cohort to covary with many such characteristics in the larger environment which are changing over time.

Finally, age and cohort certainly are predictive of whether an individual is likely to hold various adult role statuses; thus age and cohort are expected in part to work through whatever effects those role statuses have. To take an example, if being married tends to reduce illicit drug use (as we know it does), then the deferral of marriage, seen in more recent cohorts, would be predicted to have the effect of increasing drug use during the early and mid-20s.

Financial status. Recall that in our earlier discussion of availability, the other component element, besides market access, was the financial means with which to acquire drugs. We hypothesize discretionary income, moderated by the market price of drugs, to be a predictor of use. Discretionary income, in turn, is a function of total income and of adult role responsibilities, many of which carry financial burdens. We assume that many of the role responsibilities listed in Figure 3 include, among other things, financial obligations that have a high priority lien against total income. Obviously, our purpose here is not to do a careful financial accounting, but rather to show major factors likely to predict financial status. We have already demonstrated that total income is predictive of drug use during high school (Bachman, Johnston, & O'Malley, 1981b; Bachman & Schulenberg, 1993). The role of adult responsibilities has not yet been fully explored in this data set, but certainly marriage and parenthood have been shown to relate negatively to drug use in the years after high school (Bachman, O'Malley, & Johnston, 1984; Bachman et al., 1996, 2001).

Discretionary time. We also expect adult role responsibilities to operate through another closely related class of intervening variable—the amount of discretionary or leisure time available for such activities as recreational drug use. The less time available, the less such use is predicted. In other words, like discretionary income, discretionary time may be a necessary resource for at least some forms of drug use, but it may also be more than that. For the person with few role responsibilities, uncommitted time may actually be a burden and, in addition to providing a necessary resource, may also provide an increased motivation to use (Johnston & O'Malley, 1986). While we do not have a direct measure of discretionary time, we do have some indirect indicators (e.g., hours worked, school enrollment), plus the ability to make some deductions from the person's role status configuration and self-reported reasons for use. In addition, we have a set of questions about activities in which the respondent engages during leisure time. We analyzed these "routine" activities (Osgood et al., 1996) within a "Routine Activities Perspective." We found consistent evidence that socializing with peers away from home and authority figures is closely related to deviant behavior, but only in the absence of a

structuring agenda such as going on a date or participating in sports. These routine activities may help explain why or how transitions in social roles (work, family, living arrangements) are related to changes in drug use.

Other drug-using behavior. The use of other drugs, plus previous use of the drug being predicted, are obvious and central predictors of the focal behavior, for reasons discussed elsewhere (see Objective 1b). Having these variables is critical for analyses using any stage model of drug use (e.g., Kandel, 1975), and it is important to control for past drug experience in looking at the effect of role status or at almost any other variable, for that matter.

Role transitions and achievement/performance in role. As will be discussed under Objective 6, role transition and role performance, and developmental transitions in general, are important dimensions to search for possible effects of drug use. And they seem likely to be determinants of use for a number of reasons. For one, they are likely to influence the person's self-concept and satisfaction in some fundamental ways. Kaplan (1980) states that one aspect of self-concept, self-derogation, is an important determinant of use. Performance in some of these roles is also likely to affect the likelihood of choosing particular lifestyles, especially a deviant one. And poor performance in roles is likely to add to the stress experienced by individuals, for which some drugs may be used as a palliative. Finally, most roles bring with them a role-set of other people who have influence on the individual, marriage being a particularly salient example.

Performance in one role (say academic performance in high school) can influence not only the transition made out of that role (e.g., dropping out), but also the transitions made into other roles (e.g., going to college, getting a job) (Bachman, Schulenberg, O'Malley, & Johnston, 1990; Schulenberg, Bachman, O'Malley, & Johnston, 1994; Schulenberg et al., 2000). Thus the impact of poor performance in one role can reverberate and lead to further impact via transitions or performance in other roles (Schulenberg, 2001c; Schulenberg et al., in preparation). Role statuses, in turn, are important not only because of their possible psychological and economic effects on the person, but also, as is discussed above, because of their substantial impact on the type of immediate social environment experienced by that person.

1. Marriage, Pregnancy, and Parenthood. One set of role transitions which is common in early adulthood involves some or all of the following: engagement, marriage, pregnancy, and parenthood. Not infrequently, divorce and possibly remarriage follow some or all of these. One would expect such transitions to influence drug-using behaviors for a number of reasons. First, engagement and marriage mean that the respondents must deal with the expectations of a very significant person in their lives. Since most young adults disapprove of drug use and most do not use drugs (e.g. Johnston, et al., 2001b), we expect that the majority who get married receive additional role sending (and reinforcement) from their mate not to use. We have reported that there is an effect on use of becoming married (Bachman, O'Malley, & Johnston, 1984; Bachman et al., 1997a, 2002). The fact that some of this "marriage effect" actually precedes marriage, and shows up after the point of engagement, is consistent with the interpretation that role sending from the mate is an important factor. There may be other factors helping to account for a marriage effect, of course, including a change in self-concept, financial responsibilities, socializing activities, and friendship patterns. As will be described later, we have done considerable work on the effects of this and other major role transitions in the past five years.

For the woman, pregnancy carries the burden of protecting the fetus from the effects of drug use, and we have shown substantial effects from this temporary role transition (Bachman, Johnston, & O'Malley, 1991b; Bachman et al., 2002). Parenthood adds to the financial responsibilities of the parent, which may make the opportunity cost of drug expenditures higher; but perhaps more important, parents may be concerned about the underlying effects of their own behaviors on their role performance as a parent. For these reasons, we hypothesized that parenthood will have deterrent effects in use, particularly as the children get older and become more aware of their parents' behavior, and parents become more concerned about their own modeling effects on their children.

2. Jobs and Career Stage. We also hypothesized that as young people advance further into their careers, the potential loss from drug use being discovered rises. Thus, we hypothesized that those entering higher status occupations will be more likely to desist use because of the greater possible negative consequences. Also, we think that those who have a higher possibility of discovery--in particular those subjected to drug testing in the workplace—will also be more likely to desist from use. (Certainly the trends in drug use in the military would suggest this.) Both of those hypotheses have become testable in the evolving data set (see, e.g., Bachman, Freedman-Doan, O'Malley, Johnston, & Segal, 1999a; Schuster et al., 2001).

3. Lifestyle Orientations. A great deal has already been said about the presumed or hypothesized importance of lifestyle orientations, as well as other values and attitudes (e.g. Jessor, 1998; Johnston, O'Malley, & Bachman, 1987). We expect at least some types of drug use to relate to them in some historical periods, at least, because (1) such use can serve as a public, symbolic expression of a lifestyle orientation or, more likely, of a particular value/attitude stance; (2) it can serve as a ritual through which to express or attain group cohesion or loyalty; (3) it is a behavior which, by its intrinsic nature, is either consistent with a certain part of the belief system (e.g., the counter-culture emphasis on inner directedness and subjectivity) or inconsistent (e.g., the anti-chemical orientation of the "back to nature" or "healthy lifestyle" movements) (e.g., Johnston, 1973, 1991a). Being part of the "rave" scene is a more contemporary example of the connection between drug use and lifestyle. The prevalence (or even existence) of many lifestyle orientations will be heavily influenced by the age and cohort under study, of course.

Attitudes and Beliefs about Drugs

As the above discussion illustrates, many complex causal chains can be elaborated within the rather simple theoretical framework we have specified. We have tried to describe those which at present seem the most salient, given the domain of determinants within which we are working. However, as stated earlier, we view this as an evolving and iterative process in which the theory will instruct the analysis and the analysis will further instruct the theory (cf. Cattell, 1966). One of those elaborations involves a set of person characteristics in the form of beliefs about the harmfulness of drugs.

At the outset of the study we hypothesized that beliefs about the dangers of drugs and attitudes about the acceptability of their use could be important determinants of use, and of aggregate changes in use over time. We also believed that they may vary independently for the different drugs, and for different levels of use of those drugs, and as a result made a considerable investment in measuring these attitudes and beliefs separately for the various drugs and levels of

use. While we now believe that it would have been valuable to have such measures on even more drugs (such as PCP) this investment in measurement has yielded results of considerable theoretical and practical importance. Indeed, we now conclude these beliefs are, or can become, a major deterrent to initiation of use and continuation of use, and have provided evidence in support of this interpretation over the past two decades (Bachman, Johnston, O'Malley, & Humphrey, 1988; Bachman, Johnston, & O'Malley, 1990a, 1991b, 1998; Johnston, 1985; Johnston et al., 2001b and many preceding volumes in the same series). While the use of some drugs appears to have fallen for reasons other than a change in perceived risk (Johnston, 1991a), perceived risk appears to have played a pivotal role in the cases of marijuana and cocaine, and very likely in the cases of LSD, PCP, and crack (although we have more limited empirical data to support the argument in these cases, because perceived risk was not measured prospectively, as it was for many of the other drugs). In positing some of the social dynamics in the emergence, maintenance, and decline phases of an epidemic, we suggest (Johnston, 1991a) that there must be some reassurances about the dangers of a drug *before* a significant proportion of the population will even initiate use, which probably explains the low levels attained for several of the drugs perceived to be most dangerous, for example, heroin, crack cocaine, crystal methamphetamine. (Certain modes of administration are undoubtedly seen as more dangerous, as well, such as intravenous injection and the inhalation of hot fumes.) We also posit that, because most drugs have adverse side effects, there tends to be a natural correction cycle, wherein the consequences eventually manifest themselves, become known to the population, and motivate people to avoid or desist using. However, this cycle can range from several days to several decades, depending on how severe and obvious the acute effects and chronic effects are. Cigarettes have provided one of the longest cycles observed so far, marijuana a long cycle of perhaps fifteen years, and PCP and crack some of the shortest cycles of just a few years. We note that these cycles can be shortened by two intentional and purposeful activities—increased research on consequences and clinical monitoring for adverse effects, and more rapid dissemination of the results to the population at risk. These constitute important ways in which science and education can help to reduce drug use and have increasingly become the strategies pursued by the National Institute on Drug Abuse in recent years. (NIDA is now pursuing this strategy with the drug ecstasy.) We also argue that through a process of vicarious learning, the public learns from the experience of what are called the "unfortunate public role models," whose own tragic consequences resulting from drug use have the effect of changing the risk others associate with the drug in question. Examples range from Jimi Hendrix to Len Bias to Lyle Alzado. In fact, Alzado, who attributed his brain tumor to his longtime use of anabolic steroids, intentionally set out to present himself as a negative role model for young people, and we predicted that in 1992 there would be a change in perceived risk, and perhaps in active steroid use among students, very much like the sharp drop in cocaine use (accompanied by a sharp increase in perceived risk) that occurred in the year after Len Bias' death in 1986. That prediction from the theory was confirmed a year later. (Our findings on the importance of perceived risk are parallel in many ways to findings in the public health literature in other domains, and the similarities to the Health Belief Model are discussed in Johnston, 1991a.)

We hypothesize that perceived risk operates on the relevant drug-using behavior directly, by increasing the expectation of negative health consequences, but also indirectly by influencing peer norms about the acceptability of using the drug (Bachman, Johnston, O'Malley, & Humphrey, 1988; Bachman, Johnston, & O'Malley, 1990a; Johnston, 1985, 1991a). Perhaps the clearest example of this indirect effect can be seen in the case of cigarettes, where norms about

use have changed dramatically since the release of the 1984 Surgeon General's Report on the health consequences of smoking (USPHS, 1964). In more recent years an additional factor has become salient and contributed to a further change in the norms, namely an increased awareness of the effects of smoking on *others* in the smoker's environment. While most other drugs do not appear to involve a direct physiological impact from passive consumption of the drug, they have an analogous impact on people in the users' role set who are adversely affected by the users' behaviors as a result of using the drug.[6] For example, heavy cocaine users and crack users are now understood to be dependent, and therefore desperate enough to steal from those around them in order to maintain their habit; heavy marijuana users are seen as functioning poorly in their various social roles; and so on. Thus, we believe that disapproval of these drug using behaviors has risen as a result of changes in the consequences perceived to be associated with their use, in particular the deleterious consequences for the users: but also the derivative consequences for others in the users' immediate environment. In any case, this expansion of our theoretical framework, with its emphasis on the direct and indirect effects of the risks perceived to be associated with various forms of drug use, has proven to be an exciting and, we believe, important one.

Comparison with Jessors' Theoretical Approach

Those familiar with the theoretical work of the Jessors and colleagues will see a number of similarities between our own conceptual framework and that proposed by them for explaining problem behavior (Jessor & Jessor, 1977, p. 38). This is due in large part to the fact that both their work and ours (which began in the mid-1960s with Youth in Transition) grew out of the Lewinian field-theoretical approach, as well as the fact that both also draw heavily upon social learning theory. It may be useful to highlight some of the differences between the two theoretical frameworks, however. First, we do not include most of the elements listed under the general rubric of "socialization" in their conceptual framework (e.g., parental ideology, home climate, friends' interests). Secondly, our model, as illustrated in Figure 3, contains one major element not in the Jessor model—the role statuses held by the person—and emphasizes under ascriptive characteristics the *cohort* of the person as a determining variable. Some other important differences are to be found in the variables listed under the personality and behavioral systems in the two frameworks. While we have considerably more variables dealing with role performance and role achievements, the Jessors include at least one additional "problem behavior" (i.e., sexual precocity) which we do not, primarily for practical reasons. The current study also lays a great deal more emphasis on a broad array of lifestyle orientations and other social values and attitudes, given the extensive measurement we devote to those areas. We also include more variables having to do with access to drugs, as well as the means for acquiring them. Under environmental determinants, we lay emphasis on characteristics of the high school and the post high school environment(s) in which the person is located. Finally, the emerging importance in our own work of the perceived risk associated with various types of drug use is another distinguishing characteristic of particular import.

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[6] Impact on the fetus of use by a pregnant woman is one important example of the direct effects of passive consumption, and it appears to operate for most drugs. Indeed, we have found evidence that the concern about this type of derivative consequences has influenced appreciably the drug-using behaviors of pregnant women (Bachman, Johnston, O'Malley, 1991b).

Another type of difference may be found in the fact that the Jessors and colleagues group their behaviors separately from the personality system, whereas we group all behaviors except the focal drug-using behavior with the personality system. Their approach is dictated partly by the fact that they define their dependent variable more broadly as "problem behavior," and most of their behavioral measures relate to this hypothetical construct. In Monitoring the Future we have a very wide range of behaviors, many of which we think have direct and indirect causal impacts on drug use; and separating them from the focal behavior helps to make that clear. We also have concluded that a general deviance factor, such as the one posited by Jessor and Jessor (1977) under "problem behavior," accounts for only a part of the explainable variance in various forms of drug use (Osgood, Johnston, O'Malley, & Bachman, 1988). Further, our conceptual definition of "lifestyles," which comprise an important set of person characteristics to be related to drug use, can include not only attitudes and values but also behaviors. Therefore grouping all of these person characteristics together in the framework helps to show that they will be examined together as we attempt to discover and document latent variables in the lifestyle domain.

Indexes vs. Individual Variables

One noteworthy characteristic of the study has been the extent to which we treat many variables on a stand-alone basis, rather than combining them into scales or indexes—particularly the measures of drug use and drug-related attitudes and beliefs. We have done this because we have learned that each class of drugs varies over time differently than some or all of the other drugs (Johnston et al., 2001b, and preceding volumes). Had they been treated in a combined way, much important and explainable variance would have been lost, along with key findings based on it. Likewise, the attitudes and beliefs about the various drugs—in particular, perceived risk—tend to move quite independently over time for the different drugs, suggesting that much of what is learned about drugs is drug-specific. A global index of "perceived risk of drugs" would have lost much of the real action found for marijuana and cocaine, for example. In fact, we have separate measures of perceived risk associated with different patterns of use of any specific drug (for example, perceived risk of harm from experimental versus regular use of cocaine); we have found these distinctions to be important. The most striking example came with cocaine, where usage rates did not change in the early 1980s, despite an increase in the perceived risk of regular cocaine use. It was only when the risk associated with experimental or occasional use began to change—which it did after 1986—that adolescents' use of cocaine began to decline. In sum, these distinctions proved very important both theoretically and empirically.

We have built a number of indexes and used them extensively, when that seemed appropriate, but we are also mindful that critical information can be lost in the process of combining variables. Where drug use and related attitudes are concerned, we believe that our propensities have been well rewarded over the years by the way in which reality has unfolded. If anything, one regret we have is that we did not have information on additional individual drug classes, so that we could conduct similar analyses to the ones we have conducted on marijuana and cocaine, on which we also have a full complement of measures.

Having reviewed the core theoretical and conceptual underpinnings of the study, we return to discussion of its multiple objectives. We hope it will be clear how our approach to each objective fits into the larger theoretical and conceptual approaches we have adopted. As should

become obvious in the discussion to follow, there are additional theoretical perspectives that have emerged as our experience with the study has cumulated and, particularly, as the panel data accumulated and could be analyzed.

Table 1. CLASSES OF DRUG USE INCLUDED IN THE STUDY[1]

- Any illicit drug*
- Any illicit drug other than marijuana*
- Any illicit drug, including inhalants*
- Cannabis*, plus
  - Marijuana, specifically
  - Hashish, specifically
- Hallucinogens*, including
  - LSD*, specifically
  - Hallucinogens other than LSD*†
  - PCP, specifically
  - MDMA* ("Ecstasy")
- Sedatives, including
  - Barbiturates*, specifically
  - Methaqualone, specifically
  - Rohypnol*, specifically
- Tranquilizers*†
- Amphetamines*†, plus
  - Methamphetamine*
  - Crystal Methamphetamine ("Ice"), specifically
  - Ritalin*
- Cocaine*, plus
  - Crack*, specifically
  - Powder cocaine, specifically
- Heroin*
  - Heroin with a needle*
  - Heroin without a needle*
- Narcotics other than Heroin*†
- GHB*
- Ketamine*
- Inhalants*, plus
  - Amyl and Butyl Nitrites, specifically
- Alcohol*, plus
  - Beer*, specifically
  - Wine, specifically
  - Wine Coolers*, specifically
  - Hard Liquor, specifically
- Cigarettes*
- Bidis*
- Kreteks*
- Smokeless Tobacco*
- Anabolic Steroids*
- Androstenedione*
- Creatine*‡
- Over-the-Counter Psychoactive Substances, including
  - Diet Aids
  - Stay-Awake Stimulants
  - "Look-Alike" Stimulants
- Any drug by injection

[1]All classes are included in the twelfth grade and the twelfth-grade follow-up questionnaires except for a few that are not included in the follow-up questionnaires—Methaqualone, the nitrite inhalants, GHB, Ketamine, Ritalin, bidis, kreteks, androstenedione, creatine, and smokeless tobacco.

* Included in eighth and tenth grade questionnaires.

† A more detailed listing of specific drugs in this class is asked of 12th graders, and the results are reported annually in Johnston et al., 2001b (Volume I), Appendix E.

‡ Not a psychoactive substance.

Part 2

AN ELABORATION OF EACH OBJECTIVE, ITS RATIONALE, RELEVANT LITERATURE, AND PROGRESS TO DATE

Each of the objectives and sub-objectives listed earlier will be elaborated and discussed in the context of the relevant literatures and theories. The study's progress to date in accomplishing each also will be discussed.

Objective 1: To continue monitoring a broad range of drug-related behaviors, as well as explanators of change—including attitudes, beliefs, and perceptions across nationally representative samples of eighth, tenth, and twelfth grade students. This annual monitoring began in 1975 for twelfth grade students, and in 1991 for eighth and tenth grade students. The specific characteristics to be monitored will be detailed under the 11 sub-objectives which follow.

During the 1980s, there was a sustained, overall decline in drug use, and a change in many related attitudes and beliefs toward drug use, among the nation's high school seniors. Although this good news suggested that the nation was making important strides in the "war against drugs," it was clear that a serious drug problem among youth continued (Johnston, O'Malley, & Bachman, 1991; Oetting & Beauvais, 1990). The substantial increases that were observed in the first half of the 1990s demonstrated emphatically the drug problem has not been solved (Johnston, O'Malley, & Bachman, 1995). As Musto (1991) and Johnston (1991b) have argued, once the lessons of the most recent epidemic are forgotten, the stage may be set for a new one.

Continued monitoring of drug use among the nation's youth is necessary if we are to advance our understanding of national drug epidemics. In particular, continued monitoring of the various potential explanators of drug use is essential to explanations of national trends in drug use over time. The results, of course, will bear directly on matters of prevention and policy intervention. In addition, continuing to monitor drug use and related factors among the nation's eighth and tenth graders will permit an examination of factors that contribute to initiation and maintenance of drug use throughout adolescence, as well as a more precise consideration of variation in the short- and long-term consequences of drug use as a function of age of initiation (cf. Rutter, 1988). The specific potential explanatory factors to be monitored are detailed under ten of the sub-objectives below (1b through 1k).

Objective 1a: To continue to monitor self-reported use of over 40 classes and subclasses of drugs, both licit and illicit (see Table 1 for a full listing).

For the sake of efficient discourse we often use the term "drug use," although this term actually refers to a rather large number of discrete behaviors that can be, and are being, measured and monitored separately. Sets of measures are provided for each of the following classes of drugs: cigarettes, smokeless tobacco, alcohol (including beer, liquor, wine, and wine coolers separately), cannabis, LSD, other hallucinogens, PCP specifically, MDMA (ecstasy), cocaine, crack specifically, powdered cocaine specifically, amphetamines, methamphetamine, crystal methamphetamine (ice) specifically, tranquilizers, barbiturates, Rohypnol, methaqualone, heroin taken by injection and heroin taken by other means, narcotics other than heroin, GHB, ketamine, inhalants, and steroids. (See Table 1 for a full listing of the drugs.) More detailed measures of some of the specific drugs within these general classes are secured on one of six questionnaire forms used for the twelfth grade students. For the psychotherapeutic drugs, most questions deal with use that is not "under a doctor's orders," although some limited information on medically directed use is also obtained.

Frequency (and prevalence) of use is secured for three time intervals for most classes of drugs—lifetime, last 12 months, and last 30 days. A current daily, or near daily, use measure is derived from the 30-day measure. For cigarette and smokeless tobacco use, annual use is not obtained and daily use is obtained directly. In a few cases of newer, less used substances, including bidis, kreteks, and creatine, only the last 12-month interval is used in order to conserve precious questionnaire space.

Recognizing the substantial difficulties involved in determining quantities of illicit substances ingested, in terms of standard weights or other measures, we have included two surrogate measures of quantity: (1) the length of time the person stays "high" on an average occasion of use; and (2) the person's subjective assessment of "how high" he or she usually gets. For marijuana two other quantity measures are also included: ounces per month and number of joints smoked per day.

Continuing to monitor the frequency/prevalence of drug use among the nation's eighth and tenth graders has important implications for understanding both the etiology and prevention of drug use during adolescence. In particular, monitoring drug use at the eighth grade, and tracking it both cross-sectionally and longitudinally into the tenth and twelfth grades and beyond, will make it possible to examine developmental trends of drug use during adolescence, as well as to link drug use initiation and early maintenance with various related factors (e.g., attitudes regarding risk and disapproval of drug use).

Findings on levels and trends on the frequency/prevalence and quantity measures are routinely presented in the study's annual NIDA-published monographs (e.g., Johnston, O'Malley, & Bachman, 2001a, b) and the annual volumes of descriptive results (e.g., Bachman, Johnston, & O'Malley, 2001a).

Objective 1b: To continue to monitor patterns of initiation of use and non-continuation of use.

A key issue in the study of drug abuse is initiation, the movement from being a non-user to being a user (Clayton, 1992). It is important to know the age at which individuals begin to use various drugs, in part because that information provides a guide to the timing and nature of

various interventions in the school, the home, and the larger society (for example, media campaigns or in-school curricula). Any such interventions are likely to be considerably less effective in preventing drug use if administered after the ages of peak initiation. And they are likely to be less effective if they substantially precede this decision-making period. Users' ages of peak initiation vary according to drug and tend to progress from drugs seen as the least risky, deviant, or illegal toward those that are more so.

Monitoring the Future has been tracking the age (or more precisely, the grade level) at which American young people say that they initiated use of the various licit and illicit drugs since 1975 for twelfth graders, and since 1991 for eighth and tenth graders. One would not necessarily expect today's eighth, tenth, and twelfth graders to give the same retrospective prevalence rate for a drug, even for a given grade level (say by sixth grade), because the three groups differ in a number of ways. First, the lower grades contain some students who will drop out of school. The lower grades also have lower absentee rates. For any given year, both factors should cause the prevalence of use rates derived directly from eighth graders to be higher for a given calendar year than the retrospective prevalence rates for eighth grade derived from the same cohort of young people who still are students in tenth grade or twelfth grade. Second, because each class cohort was in eighth grade in a different year, any broad secular (historical) trend in the use of a drug could contribute to differences in respondents' reports of their experiences when they were in eighth grade. Third, because the eighth, tenth, and twelfth graders are in three different class cohorts, any lasting differences among cohorts ("cohort effects") could contribute to a difference at any grade level, including eighth grade.

Two types of method artifacts could also explain observed differences in the retrospective reports of use by eighth, tenth, and twelfth graders. One is that memory errors are more likely for the older respondents. They may forget that an event ever occurred (although this is unlikely for use of drugs) or they may not accurately remember *when* an event occurred. For example, an event may be remembered as having occurred more recently than it actually did—a kind of "forward telescoping" of the recalled timing of events. Another is that the definition of the eligible event may change as a respondent gets older. Thus, an older student may be less likely to include an occasion of taking a sip from someone's beer as an occasion of alcohol use, or an older student may be more likely to exclude appropriately an over-the-counter stimulant when asked about amphetamine use. While we attempt to ask the questions as clearly as possible, some of these drug definitions are fairly subtle and are likely to be more difficult for the younger respondents. (In fact, in our annual reports, we omit eighth and tenth graders' data on their use of barbiturates and other narcotics precisely because we judged them to contain erroneous information.[7])

We routinely report findings on grade of first use in terms of the percentage of students who (retrospectively) report having used as of a certain grade. "Average age of initiation" (first use) is another way to report data on grade of first use, but we believe that it can be misleading at times. For example, the average age of initiation could be lower in more recent classes because

[7]We have found that follow-ups of high school seniors into young adulthood lead to a higher recanting rate for the psychotherapeutic drugs, in contrast to the illegal drugs. We interpret this discrepancy as reflecting, in part, a better understanding of the distinctions between prescription and non-prescription drugs in young adulthood. (See Johnston & O'Malley, 1997.)

fewer people are initiating use at *later* ages than were doing so previously (perhaps due to a downward secular trend at that time). There may be no more that started at younger ages at all. Or the average age of initiation could be rising because more people are initiating at older ages (perhaps because of a recent upward secular trend), again with no necessary change in the proportion starting at young ages. We suspect that most observers, when they hear that the average age of initiation has gone down, conceptualize this fact as reflecting some shift in the propensity to use at younger ages, independent of any secular trends, and therein lies the potential confusion. For this reason, we have chosen to report data in terms of trends in lifetime prevalence at different grade levels.

As we indicated earlier, one would not necessarily expect today's eighth, tenth, and twelfth graders to give the same retrospective prevalence rate for a drug, even for a given grade level (say by sixth grade), and indeed we find some differences. In the 2000 surveys, 7.3 percent of eighth graders reported having used marijuana by the end of the sixth grade, compared to 5.7 percent and 2.4 percent of the tenth and twelfth graders, respectively. This pattern of higher estimates for the younger grades is consistent across all substances, and is not surprising, for the reasons noted earlier.

Non-continuation. Another key issue in the study of drug abuse involves the decision to continue use, once initiation has occurred (Clayton, 1992). The complement of continuation is non-continuation. Just as it is important to track initiation rates, so too is it important to track those who cease to use after having initiated use. One indication of the proportion of people who try a drug but do not continue to use it can be derived from calculating the percentage of those who ever used a drug (once or more), but who did not use it in the 12 months preceding the survey.[8] Given this operational definition, we prefer the word "non-continuation" rather than "discontinuation," because the latter might imply discontinuing an established pattern of use, whereas our current operational definition includes non-continuation by experimental users as well as established users.

Whenever prevention programs are designed—whether for schools, families, communities, or the media—questions arise as to what *should* be prevented and what *can* be prevented. While it is axiomatic that the initiation of use should and can be prevented, there is considerably less consensus as to whether the discontinuation of use is a realistic goal. We believe that the results we have been reporting help to inform that debate considerably.

It is clear that the totality of social forces that brought about the large declines in drug use during the 1980s and the substantial increases in use during the 1990s operated through their effects on *both* initiation rates and non-continuation rates. As discussed in Johnston et al. (2001b), the observed decreases and subsequent increases in annual and 30-day prevalence of use rates were considerably larger than could be explained by fluctuations in initiation rates alone. These findings show that non-continuation can change, and has changed, appreciably;

[8]This operationalization of noncontinuation has an inherent problem in that users of a given drug who initiated use during the past year by definition cannot be noncontinuers. Thus, the definition tends to understate the noncontinuation rate, particularly for drug use that tends to be initiated late in high school rather than in earlier years.

therefore, any comprehensive prevention strategy should include increasing cessation as one of its objectives.

We have found that it is important to distinguish among users at different levels of involvement. Very appreciable proportions of beginning users can be dissuaded from continuing their use; as demonstrated by the high non-continuation rates. For example, of twelfth graders in 2000 who had used cocaine, 37 percent were "non-continuers." But once users have reached a certain level of involvement (even as few as 10 occasions of use), only very modest proportions have been dissuaded from continuation—even in the best of times. For example, of twelfth graders in 2000 who had used cocaine ten or more times, only 18 percent were "non-continuers." This makes early intervention not only a viable goal for prevention but also a particularly important one.

Objective 1c: To continue to monitor patterns of multiple drug use, both concurrent and non-concurrent.

The term "multiple drug use" captures two quite different concepts: (1) concurrent use, that is, use of more than one drug for overlapping effects; and (2) nonconcurrent use, that is, use of multiple drugs over longer time intervals. (The term "polydrug use" is also used [Collins, Ellickson, & Bell, 1998].)

In the case of concurrent use, the drugs may be taken sequentially for offsetting effects, as is often the case for "uppers" and "downers," or they may be taken simultaneously for enhanced effects—for example, marijuana with cocaine. The method put forth by Johnston (1975) for systematically measuring such concurrent use was adopted in the Monitoring the Future questionnaire in Form 1 (twelfth grade only); it obtains concurrent use for selected pairwise combinations of multiple use of 11 classes of drugs. As an illustration, we found that the concurrent use of cocaine and marijuana among the nation's high school seniors steadily declined over the decade of the 1980s. In 1980, one in three cocaine users indicated concurrent use of marijuana most times or every time they used cocaine during the past year. That ratio dropped to one in four in 1984, and to one in five in 1988 (Bachman, Johnston, & O'Malley, 1981a, 1985, 1991a). Because these and other changing patterns of concurrent use are of rather obvious importance from the perspectives of education, prevention, and treatment, we believe that monitoring and reporting these patterns can provide policymakers and the treatment community valuable information on an ongoing basis. It may also identify patterns of use worthy of further investigation by the research community.

Nonconcurrent use has been dealt with in the research literature in several different ways: (1) creation of a composite measure of involvement, usually emphasizing the *seriousness* of involvement; (2) conceptualization of a hypothetical, *latent construct*, usually for use in structural equation modeling; and (3) establishment of an index that captures the *sequence* of use. Some analysts have derived an index that attempts to combine in a single summary measure some important properties of drug use; for these purposes, some type of explicit or implicit "seriousness" index is usually involved. Such an index has a practical benefit because it allows the investigator to utilize a single variable for analysis purposes, rather than numerous separate drug use indicators. Lu (1974) and Clayton and Voss (1981) provided detailed examples of this

type of index development. Needle, Su, and Lavee (1989) have compared the empirical utility of three different strategies for constructing such a measure.

In other analyses, particularly those involving structural equation methods, a hypothetical latent construct is sometimes invoked. For example, in examining the several possible consequences of adolescent drug use, Newcomb and Bentler (1988) relied on an adolescent "Drug Use" construct based on the commonality among the frequency of cannabis, hard drug, and alcohol use; and Kaplan, Johnson, and Bailey (1988) employed measures of marijuana use, narcotic use, and selling of narcotic drugs as indicators of "Drug Use" in their series of analyses. Latent class analysis (Uebersax, 1994) and latent trait analyses (Collins, Graham, Rousculp, Fidler, Pan, & Hansen, 1994) also utilize a hypothetical latent construct to investigate patterns of drug use.

Still another and particularly fruitful way to use information on multiple drug use is to investigate the sequential nature of involvement. A useful question is whether there is a modal pattern of progression of use through various types of drugs, usually based on lifetime use; if so, then one can establish stages into which users may be categorized, a topic that has been of continued importance for more than two decades (e.g., Donovan & Jessor, 1983; Elliott, Huizinga, & Menard, 1989; Golub & Johnson, 2001; Hays, Stacey, Widaman, DiMatteo, & Downey, 1986; Hays, Widaman, DiMatteo, & Stacey, 1987; Huba, Wingard, & Bentler, 1981b; Johnston, 1973; Kandel, 1975, 1988; Kandel, Yamaguchi, & Chen, 1992; Newcomb & Bentler, 1986a; O'Donnell, Voss, Clayton, Slatin, & Room, 1976; Single, Kandel, & Faust, 1974; Welte & Barnes, 1985; Windle, Barnes, & Welte, 1989; Yamaguchi & Kandel, 1984a, 1984b).

These various approaches to nonconcurrent use share many similarities. The first and third often produce very similar categories, as well as indexes that have Guttman-like scaling properties. However, the third (sequential) approach explicitly incorporates a developmental progression, whereas the first (seriousness) and second (latent constructs) usually do not. The first two approaches can of course, be used to study longitudinal changes in drug use, but in general they do not explicitly attempt to model *sequences* of use.

A second feature that varies among the three approaches is the inclusion or exclusion of licit drug use, particularly the use of cigarettes and alcohol. The sequencing approach almost always includes such licit substances as components of the initial stages, whereas the seriousness of involvement approach often has excluded alcohol or (more frequently) cigarette use, because the seriousness of alcohol and particularly cigarette use is difficult to compare to the seriousness of using various illicit drugs. The latent construct approach sometimes includes licit substances (e.g., Newcomb & Bentler, 1988) and sometimes does not (e.g., Kaplan et al., 1988).

As indicated above, conceptualizing drug use in such composite indexes yields the practical advantage of allowing the investigator to utilize a single variable for analysis purposes, rather than numerous separate drug use indicators. From a theoretical standpoint, it permits the examination of predictors of various stages or degrees of involvement with psychoactive substances (Kandel, 1980) and permits the examination of certain user groups for whom use of one drug is not confounded with the use of others. For example, in much of our own work we have separated those who have used only marijuana from those who also have used other illicit drugs (Johnston et al., 1995; Johnston, O'Malley, & Eveland, 1978). Many other investigators

have made the same distinction. When investigating the possible connection between marijuana use and delinquent behavior, we found that the marijuana-only group was very close to the abstention group in their levels of theft, vandalism, and interpersonal aggression. Had all marijuana users, including users of other illicits, been included in those comparisons, the apparent association between marijuana use and delinquency would have been far stronger, and misleadingly so, we believe.

In another example of the possible disadvantages of grouping marijuana and all other illicit drugs into one category, we have found that various illicit drugs have had quite different patterns of change in use over time (Johnston et al., 2001b). While the proportion of high school students using marijuana had been rising steadily in the 1970s, the proportion who became involved with other illicits remained fairly stable. During the 1980s these two proportions decreased steadily. But this synchronous change conceals important changes in cocaine use, which increased in the late 1970s, changed little between 1979 and 1984, peaked in 1985 and 1986, and declined substantially for some years thereafter.

Although not based on multiple drug use indexes, a related finding of this type has emerged regarding the connection between alcohol use and marijuana use. Some time ago, a popular hypothesis, particularly among marijuana advocates, was that increased use of marijuana would lead to a decline in alcohol use, since both drugs are used for many of the same reasons. While our data on reasons for use do show a very similar profile for these two drugs (Johnston & O'Malley, 1986), our usage data at the aggregate level have not supported that sanguine hypothesis. As marijuana use among students increased considerably in the 1970s, the frequency of alcohol use did not decline; rather, it rose slightly. Conversely, as marijuana use declined during the early 1980s, the prediction made by some observers that alcohol consumption would rise, or had already risen, received no empirical support; instead, alcohol use decreased. And while marijuana use increased substantially in the mid-1990s, alcohol use was relatively stable or increased slightly. In other words, contrary to what we have labeled the "displacement hypothesis," the overall demand for, or propensity to use, alcohol *and* marijuana moved in the same direction, not in opposite directions. This information is useful in conducting critical tests of competing theoretical perspectives concerning drug epidemics and the nature of substance use during adolescence.

As mentioned previously, the topic of drug use sequencing during adolescence has been of continued importance over the past few decades. Determining whether there is an invariant sequential progression of drug use, and, if so, delineating that sequence and identifying the factors that contribute to progression, are essential steps for an understanding of the etiology and prevention of drug use during adolescence and young adulthood (Kandel, 1988). Although there were several earlier studies relevant to drug use sequencing (e.g., Jessor & Jessor, 1977; Johnston, 1973; Kaplan, Martin, & Robbins, 1982), it was Kandel (e.g., Kandel, 1975; Single et al., 1974) who conducted the first in-depth study of drug use sequencing during adolescence. Among the several important findings, Kandel offered a four-stage model of drug use sequencing during adolescence: first, beer/wine (termed the "entry drugs"); then cigarettes and/or hard liquor; followed by cannabis; and finally, other illicit drugs (see also, e.g., Kandel & Yamaguchi, 1993, 1999).

Although several of the studies cited earlier provide some support for a generalized sequence similar to the one delineated by Kandel, whether there is a specific invariant sequencing during adolescence is still at issue. Specifically, in contrast to this "stage theory," there is a "common influence theory," in which no invariant sequence is assumed, but rather a general proclivity towards drug use (e.g., Huba & Bentler, 1983; see also Kandel, 1988), an assumption consistent with problem-behavior theory (Jessor & Jessor, 1977). There have been several studies comparing elements of these two perspectives. Using structural equation modeling techniques with lifetime drug use data, Huba et al. (1981b) compared a simplex model (in which alcohol use contributed directly to cannabis use but not to hard drug use, and cannabis use contributed directly to hard drug use) to a common-factor model (in which all three constructs were permitted to correlate); in support of the stage theory, they found that the simplex model provided a more parsimonious fit to the data. In contrast, Hays et al. (1987) found that a common-factor model provided a better fit than a simplex model, and that a four-factor model (with hard drugs separated into a "enhancer" factor and a "dampener" factor) provided a better fit than a three-factor model. They used current drug use data, which may have partially accounted for findings inconsistent with the Huba et al. (1981b) findings; and in fact, in an earlier analysis, Hays et al. (1986) found evidence suggesting that the simplex model is more appropriate for lifetime than for current drug use data. Nevertheless, in a later study employing current drug use data, Windle et al. (1989) accepted a four-factor (including enhancer and dampener factors) simplex model over a common-factor model.

These apparent inconsistencies in the findings regarding simplex and common-factor models suggest the need for additional studies and, we believe, additional approaches. As Newcomb and Bentler (1986a) suggest, the discrepancy between the two models may be a matter of differences in level of abstraction, with the common influence model being a higher-order representation, and the stage model being a lower-order or manifest representation. The two models may also represent different approaches to the data, with the common influence model reflecting a variable-centered analytic approach, and the stage model reflecting a pattern-centered analytic approach (cf. Magnusson, 1988; von Eye, 1990). To illustrate, in some earlier, unpublished analysis, we took a pattern-centered approach to analyzing the retrospective data from the 1990 high school seniors regarding the grade that they first used the various classes of substances. Our preliminary findings were quite consistent with a stage model. For example, focusing on four classes of substances which we hypothesized would be used in sequence (cigarettes and/or alcohol; marijuana; pills; crack cocaine and/or heroin), we found that: (a) among those who used only one of these classes of drugs, 99 percent used the first class; (b) among those who used any two classes of drugs, 70 percent used cigarettes and/or alcohol first and then marijuana, 18 percent used both classes during the same year, only 5 percent used marijuana first and then cigarettes and/or alcohol, only 7 percent used pills, and none used crack and/or heroin; (c) among those who used any three of these classes of drugs, 87 percent had a sequencing pattern consistent with that hypothesized, and less than 1 percent had ever used crack and/or heroin; and (d) among those who used all four classes of substances, 88 percent had a sequencing pattern consistent with that hypothesized. Findings were generally the same across gender, although females were typically quicker to move into pills than were males—perhaps for the instrumental purpose of weight control.

In addition to the appropriate representation of any sequential ordering, there are several other unresolved issues in the relevant literature. For example, as Newcomb and Bentler (1986a)

and Graham et al. (1991) suggest, the age of entry into the sequence may have an impact on any ordering effects, and in fact, there may be several mini-sequences between adolescence and young adulthood. Furthermore, insufficient attention has been given to potential gender differences in sequencing (but see Welte & Barnes, 1985; Windle et al., 1989; Yamaguchi & Kandel, 1984a, 1984b), to potential racial/ethnic differences in sequencing (but see Donovan & Jessor, 1983; Gilbert & Alcocer, 1988; Welte & Barnes, 1985), and particularly to *potential cohort differences* in drug use sequencing (but see Donovan & Jessor, 1983; Golub & Johnson, 2001), all of which represent critical concerns in any attempt to establish a universal sequential ordering. These and other concerns related to the appropriateness of the ordering (e.g., whether alcohol represents a true gateway drug—see Newcomb & Bentler, 1986a) or to the generalizability of the ordering (e.g., regarding potential regional or urbanicity differences due to specific drug availability, or whether the introduction of a new drug such as crack may alter the progression) can be addressed best via large-scale prospective investigations like MTF that incorporate a longitudinal cohort-sequential design. Accordingly, by adding the surveys of the nation's eighth and tenth graders, begun in 1991, we are now in a better position to provide needed understanding regarding the sequencing of drug use during adolescence and young adulthood.

Objective 1d: To continue to monitor beliefs about the harmfulness of various types of drugs at various levels of use.

Connections between beliefs and behaviors have long been at the crux of several conceptualizations regarding changes in health-related behaviors (e.g., Ajzen & Fishbein, 1980; Rosenstock, 1974) and more recently regarding changes in drug use behaviors (e.g., Johnston, 1991a; Petty, Baker, & Gleicher, 1991). As we have demonstrated, the trends in the perceived risks of substance use have played an important part in the declines in marijuana use in the 1980s (Bachman, Johnston, O'Malley, & Humphrey, 1988; Johnston, 1982, 1985; Johnston et al., 2001b and prior volumes), the declines in cocaine use in the late 1980s (Bachman, Johnston, & O'Malley, 1990a, 1990b, 1991b; Johnston, 1991b; Johnston et al., 2001b and prior volumes), and the increases in marijuana use in the 1990s (Bachman, Johnston, & O'Malley, 1998).

Other findings provided further evidence for the power that perceived harmfulness of drugs has in influencing drug use during adolescence (Newcomb, Fahy, & Skager, 1990; Nucci, Guerra, & Lee, 1991). Continued monitoring of these and related beliefs has permitted further testing of our model, and the turnaround in marijuana use among twelfth graders in 1992 actually was predicted by a turnaround in the perceived risk of marijuana, meaning that it was a leading indicator on this occasion. Changes across time in the perceived risk of marijuana, cocaine, and a number of other drugs have been consistent with our theoretical predictions (Johnston et al., 1995).

Beginning in 1989, we included questions regarding perceived risk of anabolic steroid use. This is particularly important given that formal and informal sanctions against anabolic steroid distribution and use were stepped-up during the late 1980s and early 1990s; for example, in the Anti-Drug Abuse Act of 1988, distribution of an anabolic steroid to a minor without a prescription became a felony (Yesalis, 1991). Based on our theory of drug epidemics (Johnston, 1991a) and particularly based on the predicted impact of "unfortunate role models"—public figures who suffer adverse consequences from using drugs—in the first edition of this occasional

paper, written in 1991, we stated, "We expect that the example and activities of Lyle Alzado, a professional football lineman who attributes his brain tumor to his use of anabolic steroids (*Sports Illustrated*, 1991), may well have a similar effect on adolescents' perceived risk for steroids as Len Bias' death had on their perceived risk of cocaine." As predicted, the 1992 data on perceived risk showed a five percentage point jump at all three grade levels (8, 10, and 12) in the proportion seeing "great risk" in taking steroids.

Between 1991 and 1997 the annual prevalence rate for anabolic steroids was stable in eighth and tenth grades; in 1999, use jumped (from 1.2 percent to 1.7 percent) in both grades. Almost all of the increase occurred among boys. Twelfth grade anabolic steroid use increased very gradually from 1992 to 1999. The data from twelfth graders showed a distinct drop in perceived risk of steroid use after 1998. (Unfortunately, the questions about perceived risk and disapproval were dropped from the eighth and tenth grade questionnaires in 1995 in order to allocate space to other questions.) The sharp drop in perceived risk among twelfth graders suggests that some particular event (or events) in 1998 changed beliefs about the dangers of steroids. One possible event was the disclosure by baseball player Mark McGwire, who set a new, highly publicized record for home runs in the 1998 season, that he used androstenedione. We interpret the jump in use by young boys as having been due largely to the positive "role modeling" unintentionally provided by McGwire (who subsequently publicly renounced the use of androstenedione).

Monitoring beliefs about the perceived harmfulness of psychoactive drugs is important for a number of reasons, both theoretical and pragmatic. It can provide policymakers and the public at large advance warning of things to come. The accuracy of youngsters' standing beliefs about harmfulness can be assessed in light of existing scientific knowledge, and when young people appear to have an unrealistically low assessment of the dangers involved, remedial educational efforts can be mounted (e.g., Bukoski, 1991). For example, only about one-third of the 1978 seniors felt that regular users of marijuana took a "great risk" of harming themselves physically or in other ways, and that proportion had been dropping steadily since 1975, as the number of regular marijuana users had continued to rise. However, between 1978 and 1991, there was a dramatic 125 percent increase (from 35 percent to 79 percent) in the proportion perceiving regular marijuana use as involving great risk. During the same time period, the proportion of those who indicated that even occasional users of marijuana were at great risk of harming themselves rose 227 percent, from 12 percent to 41 percent. This dramatic shift may well have been due to the fact that scientists, policymakers and, in particular, the media provided considerable attention to the increasing levels of marijuana use among young people, and to the potential hazards associated with such use. If so, the implications for prevention strategies are important (Bachman, Johnston, & O'Malley, 1991b; Johnston 1985, 1991a, 1991b).

When further research indicates that use of any particular drug carries substantial health hazards, these indicators of perceived harmfulness can be extremely useful for gauging whether and when the new facts become incorporated by young people. A case in point is cocaine. During the early 1980s, in spite of numerous negative experiences by well-known individuals (John Belushi, Richard Pryor, McKenzie Phillips, Stacy Keach, and others), the perceived harmfulness of regular or experimental cocaine use among the nation's youth had changed rather little. In fact, perceived risk of harm from *experimental* use was actually lower in 1985 (34 percent) than it was in 1975 (43 percent); it had dropped to a low point of 31 percent in 1980.

During that same ten-year period, there was some increase in perceived risk of *regular* use of cocaine, from 73 percent in 1975 to 79 percent in 1985 (it dipped to 68 percent in 1977). Still, given the media attention to the potential harmfulness of cocaine use on the one hand, and its considerable dependency-producing potential on the other (Johanson, 1984), these figures seemed inappropriately low (as we stated in 1985). This was particularly the case, given that (a) experimental use of other drugs with less dependence potential (e.g., LSD, heroin) showed distinctly higher levels of perceived risk, and (b) crack cocaine, widely reputed to be highly dependence-producing, was becoming readily available.

Then, for the senior class of 1987, we reported a dramatic increase in the perceived harmfulness of cocaine use. Between 1986 and 1987, the proportion of students who perceived *regular* use of cocaine as placing the user at great risk of personal harm rose from 82 percent to 89 percent; for *occasional* use, the corresponding percentages were 54 percent and 67 percent; and for *experimental* use, the percentages were 34 percent and 48 percent. After 1987 this increase continued, with the most substantial gains occurring for experimental use. For both crack cocaine and powdered cocaine (which we began to monitor specifically in 1987) there also was an increase in perceived harm at all levels of use. As we have discussed at length elsewhere (e.g., Bachman, Johnston, & O'Malley, 1991b; Johnston, 1991a; Johnston, O'Malley, & Bachman, 1991), we believe these changes in attitudes have resulted from two factors: (a) the greatly increased media coverage of cocaine and its dangers which occurred since 1986, including many anti-drug spots (see also Black, 1991; Donohew, Lorch, & Palmgreen, 1991); and (b) the tragic deaths in 1986 of sports stars Len Bias and Don Rogers, both of which were attributed to the effects of cocaine. The deaths of these "unfortunate role models" underscored the points that no one, regardless of age or physical condition, was invulnerable to being killed by cocaine, and that one does not have to be an addict or regular user to suffer such adverse consequences. Indeed, given the heightened feelings of invincibility that are apparently characteristic of adolescence (Elkind, 1985), perhaps these points could penetrate this shield of invincibility so quickly only because of well-publicized tragedies involving nationally known and respected individuals.

The study has identified still a third situation in which perceived risks among young people appear to be out of sync with what is scientifically known about the drug. Even as recently as 1996 only 50 percent of eighth graders thought there was a "great risk" of a pack-a-day smoker harming himself or herself physically or in other ways. Some progress has been made on this dimension in recent years, as new initiatives to prevent underage smoking have been undertaken; in 2000, 59 percent of eighth graders saw great risk.

We should mention here that, because we believed that the radio and television anti-drug Public Service Announcements (PSAs) aimed at illicit drug use might prove important in changing attitudes and behaviors, we began to monitor seniors' perceptions of these PSAs in 1987. At that time, about two-thirds (65 percent) of seniors indicated that they saw or heard at least one PSA a week, and the majority indicated that the PSAs had made them less favorable toward drugs to at least some extent (54 percent), and less likely to use drugs at least to some extent (55 percent).

This high rate of exposure, and judged impact on respondents' own behavior, continued through 1990 among seniors, before starting to drop substantially. Weekly recalled exposure was

reported by 66 percent of the class of 1990 versus 46 percent of the class of 1995. The proportion saying such advertising had made them less likely to use drugs to at least "some extent" fell from 56 percent to 39 percent over the same interval, as would be expected given the reduced exposure. The Partnership for a Drug-Free America reported a drop in the placement of their ads between 1989 and 1994 of about 25 percent, consistent with the students' perceptual reports. All of this corresponds in time, of course, to the drop in perceived risk for a number of drugs among American adolescents. (Since 1995, there have been renewed attempts to advertise the dangers of drugs, and weekly recalled exposure was at 53 percent among the class of 2000; however the proportion saying the advertising made them less likely to use actually declined a bit more, to 37 percent.) One particular campaign, in part generated by the findings from MTF that inhalant use was high and rising in the early 1990s, showed evidence of success at changing the perceived risks associated with that class of drugs. Between our 1995 and 1996 data collections, the Partnership for a Drug-Free America launched an inhalant prevention campaign, and MTF measured a four to six percentage point jump in perceived risk among eighth and ninth graders over that one-year interval. That change, in turn, has been followed for a number of years by declines in actual inhalant use.

Objective 1e: To continue to monitor personal disapproval of various types of drugs at various levels of use.

Related to beliefs about harmfulness is the dimension of personal disapproval of various types of drug use. Based on earlier work, Johnston (1973) pointed out that there were undoubtedly some gross distortions (largely media created) in the public's perception concerning the receptiveness of most young people to a drug culture. Of course, serious distortions remain in various forms today. For example, when we published findings regarding the lower rates of drug use among African American high school seniors than among Caucasian seniors (Bachman et al., 1991b), along with an accompanying press release, several editorials were written in the popular press about the incredulity that the findings engendered vis-à-vis what is typically expressed in the media about African American youth. The point here is that stereotypes regarding youths' approval or disapproval of drug use, along with other related public perceptions, represent powerful social norms (Johnston, 1991a) that, in turn, can have strong impacts on young peoples' decisions to use, or not to use, drugs (see also Bukoski, 1991; Martin & Pritchard, 1991; Perkins & Berkowitz, 1986; Rhodes & Jason, 1990). Incidentally, the racial/ethnic differences have been examined at grades 8 and 10, before substantial dropping out has occurred, to test the assertion that differential dropout rates might contribute to the lower levels of use by African Americans in twelfth grade. It turns out that these racial differences are just as strong in eighth and tenth grades (Wallace et al., 1995).

The set of questions about disapproval begins, "Do you disapprove of people (who are 18 or older) doing each of the following?" Several intensities of use (e.g., use once or twice, occasionally, or regularly) for each drug class are then listed and the respondent indicates whether he or she (1) does not disapprove, (2) disapproves, or (3) strongly disapproves of that drug-using behavior. (The eighth and tenth grade version includes an additional answer category, "Can't say, drug unfamiliar.") These questions have consistently reflected a conservatism among the great majority of seniors in relation to the illicit drugs other than marijuana. In 1975, over 74 percent disapproved of even experimental use (i.e., using once or twice) of each of the five illicit

drugs listed (cocaine, LSD, amphetamines, barbiturates, and heroin), and over 90 percent disapproved of regular use of each (Johnston, Bachman, & O'Malley, 1979). The corresponding percentages in 2000 were over 80 percent for experimental use, and over 93 percent for regular use (Johnston et al., 2001b), illustrating the increased conservatism toward use of illicit drugs. Some important changes occurred that paralleled those for perceived risk. Disapproval of experimental use of cocaine was at about 80 percent during 1984-1986, and then jumped to 87 percent in 1987; after that it steadily increased to an all-time high of 94 percent in 1991. Likewise, disapproval of experimental and regular marijuana use rose steadily from lows of 33 percent and 66 percent in 1977, respectively, to highs of 70 percent and 90 percent in 1992, respectively.

As is the case with perceived harmfulness, changes in disapproval of use of various classes of substances tend to be in the opposite direction from changes in use; we have attributed these relationships as causal ones, in which disapproval, along with perceived harmfulness, has contributed to the declines in marijuana and cocaine use (Bachman, Johnston, & O'Malley, 1998; Bachman, Johnston, O'Malley, & Humphrey, 1986, 1988; Bachman, Johnston, & O'Malley, 1990a, 1990b, 1991b; Johnston, 1985, 1991b; Johnston et al., 2001b and earlier volumes). Beginning in 1991, we also asked questions regarding disapproval and perceived harmfulness in the eighth and tenth grade surveys. Our findings since 1991 suggest that age differences depend on the drug. Among the three grade levels, eighth graders have been the most disapproving of marijuana use but the least disapproving of LSD use (Johnston et al., 2001b).

We have argued (Johnston, 1985) that disseminating the results of the yearly surveys may prove useful in prevention efforts aimed at shoring up the resolve of those trying to resist immediate peer group pressures to use licit and illicit drugs (see, for example: Botvin, Baker, Dusenbury, Tortu, & Botvin, 1990; Dielman, Campanelli, Shope, & Butchart, 1989; Pentz et al., 1989; Perkins & Berkowitz, 1986).

Objective 1f: To continue to monitor perceptions of the extent of disapproval by peers of the use of various drugs (i.e., perceived peer norms).

There is considerable evidence, listed under Objective 1h, that peers play an important role in influencing drug behaviors. It has long been recognized that not only is exposure to peers' use or non-use likely to be important, but peers' expectations and attitudes are likely to matter, as well (Jessor & Jessor, 1977; Kandel, 1974). Indeed, it appears that perceived peer norms can be as influential as perceived peer behaviors on adolescents' drug use, and particularly on their alcohol use (e.g., Biddle, Bank, & Marlin, 1980b; Harford & Grant, 1987; Newcomb et al., 1986b; Robin & Johnson, 1996; Rooney, 1982; White, Johnson, & Horwitz, 1986; Wilks, Callan, & Austin, 1989). Consequently, two sets of measures addressing these potentially important sources of social influence are being used each year. One asks the respondent to rate on a disapproval scale "How do you think your close friends feel (or would feel) about your doing each of the following things?" Various drug-using behaviors are then listed. The second set asks how drug use is viewed by (a) most students in the school, (b) most of the respondent's own group of friends, and (c) the respondent himself or herself. (Both of these sets of variables are asked of twelfth graders only.)

Peer norms differ considerably for the various drugs and for varying degrees of involvement with those drugs, but overall peer norms tend to be quite conservative. The great majority of seniors have friendship circles that do not condone use of the illicit drugs other than marijuana, and in 2000, 76 percent believed that their friends would disapprove of regular marijuana use. In fact, in 2000, 59 percent believed that their friends would disapprove of their even trying marijuana. These questions show a fairly close correspondence in results at the aggregate level with the self-reported attitudes described in the previous section, and their trends track so closely (see Johnston et al., 2001b) that we decided not to ask both sets of questions of the eighth and tenth graders

In contrast to the close correspondence noted above, another set of questions shows substantial discrepancies among (a) seniors' reports of their own beliefs, (b) their perceptions of what their own group of friends believe, and (c) their perceptions of what the majority of students in their schools believe in terms of whether using drugs (other than alcohol or marijuana) causes a student to be looked up to or looked down on. About half of the 2000 seniors (49 percent) reported that they personally looked down on such drug use "a lot," a third (33 percent) reported their own group of friends felt that way, but only 14 percent thought the majority of students in their school felt that way. This disparity implies substantial underestimation of the degree to which drug use is perceived in negative terms—a form of collective ignorance which may be modified with appropriate interventions.

Taken across time, the measures we have outlined reveal some important changes in the social reality experienced by young people. The measures about close friends can also be used longitudinally to monitor shifts in social reality occurring with age and transition into new environments. At the individual level of analysis, their predictive importance can be assessed along with their relative importance vis-à-vis other factors contributing to drug-using behaviors.

Objective 1g: To continue to monitor beliefs (or stereotypes) regarding cigarette smokers and frequent marijuana users.

Adolescents have always had a colorful nomenclature for various segments of their number: "jocks," "heads," "preppies," "punkers," "burnouts," "nerds," "loners," "druggies," "partyers" and so on (e.g., Brown, Dolcini, & Leventhal, 1997; Clasen & Brown, 1985; Durbin, Darling, Steinberg, & Brown, 1993; Mosbach & Leventhal, 1988). These labels usually carry a rich set of connotations that can vary with time and with group membership. Insofar as various classes of drug users are seen as a group with shared characteristics, it is relevant to monitor what those characteristics are presumed to be, since they are likely to determine the attractiveness of the behavior for many potential users. Indeed, this notion of being drawn to drug use because of perceptions about what may be gained in terms of self- and/or social-image or, more broadly, that problem behavior can be viewed as purposeful and constructive from the adolescent's perspective, is central to many conceptualizations concerning the etiology and prevention of drug use during adolescence (e.g., see Chassin, Presson, & Sherman, 1989; Jessor & Jessor, 1977; Kaplan, 1985; Loewenstein & Furstenberg, 1991; Rhodes & Jason, 1990; Schulenberg & Maggs, in press; Silbereisen & Noack, 1988). Three decades ago, the National Commission on Marijuana and Drug Abuse (1972) believed that the symbolic aspect of marijuana use was so important to its etiology and maintenance that they entitled their first report *Marijuana: A Signal of Misunderstanding*.

For a number of years, Monitoring the Future has included a set of measures asking the respondent's opinion concerning certain characteristics of marijuana users and users of other illicit drugs. Various dimensions are rated, some having positive connotations (interesting, creative, independent, concerned with people), others negative (not sensible, not hard-working, emotionally unstable, weak-willed, criminal). Respondents are asked to state whether or not they think "people who use marijuana several times a week" tend to have these characteristics more than average. This same series of questions is then repeated for "people who use illegal drugs (other than marijuana) several times a week." Over the decade of the 1980s, there was a clear trend for regular marijuana users to be viewed more negatively. Specifically, between 1980 and 1990, high school seniors became more likely to view regular marijuana users as less sensible and hard-working than average, and also more emotionally unstable, weak-willed, and criminal than average. The possible positive attributes of regular marijuana users changed little, although regular marijuana users were less likely to be viewed as above average in creativity in 1990 than in 1980. With the rise in marijuana use during the 1990s, the trend reversed. Regular marijuana users are viewed in less negative ways, and even the positive attributes have changed, with respondents seeing marijuana users in a more positive light. For example, in 1990, 12 percent of seniors thought users were more creative than average, and 15 percent thought they were more interesting than average; in 2000, those figures were 22 percent and 25 percent, respectively.

During the decade of the 1980s, attitudes toward illicit drug users seemed to harden somewhat. For example, in 1980 60 percent of seniors thought drug users were "more weak-willed" and 59 percent thought they were "more criminal" than average compared to 64 percent and 68 percent, respectively, of seniors in 1990. During the decade of the 1990s, attitudes toward illicit drug users seemed to go the other way, softening somewhat: for example, in 1990, 64 percent of seniors thought drug users were "more weak-willed" than average and 68 percent thought they were "more criminal" than average compared to 54 percent and 57 percent, respectively, of seniors in 2000.

Since 1981 the social connotations of cigarette smoking have also been monitored. These questions provide clear evidence that high school seniors perceive the image of a cigarette smoker negatively. For example, in 1981, in response to what smoking made a male look like, only 6 percent endorsed "cool, calm, in-control," 9 percent endorsed "rugged, tough, independent," and 5 percent endorsed "mature, sophisticated." In 1990, the corresponding percentages on these positive attributes were still only at 5 percent, 10 percent, and 3 percent, and in 2000 they were at 6 percent, 11 percent, and 4 percent. In response to what smoking made a female look like in 1981, again only 6 percent endorsed "cool, calm, in-control," 11 percent endorsed "independent and liberated," and 7 percent endorsed "mature, sophisticated." In 1990, the corresponding percentages were still only 4 percent, 10 percent, and 5 percent, and in 2000 they were at 4 percent, 8 percent, and 3 percent. By way of contrast, large proportions of the students viewed smokers their age as "trying" to look mature and sophisticated; 61 percent and 65 percent of male and female smokers were so viewed in 1981. By 2000, however, these figures were at 51 percent and 53 percent—not as high as they were two decades earlier, though still fairly high. Clearly, the modal picture provided by high school seniors of regular cigarette smokers stands in contrast to the one provided by the magazine and billboard cigarette advertisements. As is the case with disseminating information about disapproval of drug use, providing information about the extent to which cigarette smoking is viewed negatively may

have some useful value in designing prevention programs. (We did a special press release on the subject from the study for much the same purpose.)

Again, these attitudes or stereotypic views occupy a role in our theoretical model parallel to that for disapproval and beliefs about harmfulness—namely, that of an intervening variable between a number of environmental influences and actual drug use. It seems clear that what is intentionally or unintentionally symbolized by use remains a factor likely to have significant impact on usage patterns.

Objective 1h: To continue to monitor the extent of direct exposure to various forms of drug use, and to monitor the proportions of friends using various drugs.

When given the choice, most adolescents indicate that they would prefer to spend time with their friends than with anyone else; likewise, most indicate that they are happiest when they are with their friends (e.g., Crockett, Losoff, & Petersen, 1984; Csikszentmihalyi & Larson, 1984). Against this backdrop, it is not surprising that matters and activities related to drug use are the domain of the peer group. Indeed, Kandel (1974) has argued that "marijuana use by one's friends may not only be an important variable, but may be the critical variable" (p. 208) in explaining an individual's marijuana use. At the same time, it is noteworthy that friends often represent the one and only resource that adolescents would use if they were having difficulties with substance use (Johnston, 1973; Windle, Miller-Tutzauer, Barnes, & Welte, 1991). And when considering the broader developmental tasks of adolescence, and particularly that of forming close reciprocal friendships, substance use may serve as a way of facilitating bonding (see Schulenberg & Maggs, in press).

Since Becker's seminal work (Barnes & Becker, 1952), the notion that drug use is initiated through a peer social-learning process has received widespread acceptance and support. A number of investigators have shown a high correlation between an individual's illicit drug use and that of his or her friends (e.g., Bailey & Hubbard, 1990; Barnes & Welte, 1986; Bates & Labouvie, 1995; Biddle, Bank, & Marlin, 1980a; Blum, 1970; Brook, Nomura, & Cohen, 1989; Dielman et al., 1989; Dishion, Capaldi, Spraklen, & Li, 1995; Duncan, Tildesley, Duncan, & Hops, 1995; Hundleby, 1987; Jessor, Jessor, & Finney, 1973; Jessor & Jessor, 1977; Johnston, 1973, 1980; Kandel, 1982, 1985; Kandel, Davies, & Baydar, 1990; Kandel, Kessler, & Margulies, 1978; Mosbach & Leventhal, 1988; Newcomb, Maddahian, & Bentler, 1986a; Oetting, 1992). While these correlations may certainly be explained in part by users seeking friends who are also users (Ennett & Bauman, 1994; Schulenberg & Maggs, 2001; Schulenberg et al., 1999), there is reasonable evidence for the common-sense notion that having friends who are users increases one's own likelihood of becoming a user, other things being equal (e.g., Bailey & Hubbard, 1990; Brook, Nomura, & Cohen, 1989; Jessor et al., 1973; Kandel, 1974, 1978a, 1985; Kandel et al., 1990; Newcomb et al., 1986b; Oetting & Beauvais, 1987; Sieving, Perry, & Williams, 2000; Welte, Barnes, Hoffman, & Dintcheff, 1999).

In an article on the interpersonal determinants of adolescent drug abuse, Goldstein (1975) suggested that some of the factors that have emerged from research on interpersonal attraction could explain the importance of peer usage. In addition to the obvious ones—providing accessibility to the drug and social pressure to use it—these factors include providing models of appropriate behavior, providing a more comforting and less uncertain situation in which to

experiment with a new behavior, teaching about the proper techniques and paraphernalia for use, and reassuring the subject as to the safety of the new behavior. If these are some of the key intervening variables through which peer influence works, it follows that as some of these processes are mediated through other social means, particularly the media, use by friends may become a less important determinant of a person's drug use. However, it seems likely that peers will continue to play a unique role in influencing drug use of adolescent peers. Because we expect that exposure to use, in general, and modeling by close friends, in particular, will remain important factors, they are included also in our theoretical model of the determinants of drug use. We also have argued that inter-cohort transmission from older acquaintances and siblings to slightly younger ones is one important dynamic through which an epidemic is sustained, once begun (Johnston, 1991a).

Built into the monitoring system are several sets of questions dealing with exposure to various types of drug use ("being around people who were using. . .") and use by one's friends. Responses on these measures were reported for the first time in 1979; we found that responses about being around people who were using drugs to get high in the last 12 months showed a high degree of correspondence at the aggregate level with reports about use by friends. Reports of exposure and friends' use also corresponded closely with the figures on seniors' own use. Not surprisingly then, the highest levels of exposure involved alcohol (a majority said they were "often" around people using it to get high) and marijuana (39 percent "often" and 25 percent "occasionally" around people using it to get high). It was more surprising to find that fully 32 percent of all seniors said that most or all of their friends get drunk at least once a week, and this has changed rather modestly—the corresponding figure for 1995 was 27 percent, and for 2000 it was back to 32 percent. The marijuana figures have changed over time in a manner consistent with individual use rates—that is, peaking in 1978-79, declining through 1991-92, increasing sharply through 1995, before leveling or declining some. For example, in 1979, 36 percent of seniors said most or all of their friends smoked marijuana, in 1991 only 10 percent indicated the same, in 1995 21 percent did, and in 2000 23 percent did.. For each of the drugs other than marijuana or alcohol, a majority of seniors (usually a large majority) report that in the past year they had not been around people using the drug to get high, and most indicate that none of their friends use the drug.

An additional benefit derived from inclusion of questions on friends' use of drugs and exposure to drug use has to do with validating the trends in self-reported use. Presumably, there is considerably less motivation for a respondent to conceal information on the proportion of unnamed friends who use, or the extent of their own exposure to use, than there is to conceal their *own* use in the self-report usage questions. Therefore, a high degree of correspondence in the aggregate level data between seniors' self-reports of their own drug use, and their reports concerning friends' use and exposure to drug use, suggests that there has *not* been a serious change in underreporting of own use. To date we have found a high degree of correspondence, and this provides additional evidence for the validity of the self-report trend data (Johnston et al., 2001b).

If there should be any future change in the extent to which high school seniors are willing to be candid in reporting their drug use, then reports of friends' use and exposure to use might

begin to diverge from self-reports. However, as long as these indicators move in concert, we will continue to feel comfortable about their validity.[9]

In 1991, we began to monitor the same peer usage perceptions among the nation's eighth and tenth graders. Like the data from the twelfth grade, these data show trends that are highly consistent with the trends in self-reported use.

Objective 1i: To continue to monitor perceived availability of the various illicit drugs.

Availability is a necessary condition of use, and MTF gathers measures of availability based on population survey data rather than social agency and control agency statistics. As we stated a quarter century ago:

> Various indicators of drug availability through illicit channels have been developed—for example, indexes of price and purity of drugs bought on the street by undercover agents and police informants. However, most of these efforts have been addressed specifically to heroin availability. To our knowledge, there has been much less effort to measure the availability of most other drug classes and there has never been an attempt to sample systematically either populations "at risk," e.g., high school students, or actual users, for the purpose of monitoring through survey techniques their perceptions regarding the availability of drugs. In this study we attempted to make such an assessment. (Johnston, Bachman, & O'Malley, 1977, p. 179)

We use the term "perceived availability," but we recognize that availability is multidimensional, and that respondents may take into consideration a variety of factors, including knowing where to get access to a drug, the difficulty of getting to an access place, and perhaps also the monetary cost.

There are substantial differences in the perceived availability of the various drugs. In general, the more widely used drugs are reported to be available by high proportions, as would be expected. Also as would be expected, drugs are generally perceived to be more available to older adolescents than to younger adolescents. Both associations are consistent with the notion that availability is largely attained through friendship circles; the higher the proportion of a friendship circle that uses a drug, the greater the proportion of students who have access to it.

Similarly, in general, as use increases (or decreases) over time, availability tends to increase (or decrease); however, there are some very important exceptions to this generality.

Of special note is the fact that marijuana has continued to be perceived as almost universally available by high school seniors, even though use has fluctuated considerably. At its peak of popularity, around 1979, about 90 percent said that marijuana would be "fairly easy" or

[9] In fact, a question about the validity of our reported downturns during late 1970s in rates of cigarette use was raised, based on just such an hypothesis about changed willingness to report cigarette use in an era when cigarette use was becoming viewed with more disfavor (Mittelmark, Murray, Luepker, & Perchacek, 1982). The fact that reported friends' use was also declining helped to answer that question (O'Malley, 1984).

"very easy" to get. At its low point, in 1992, 83 percent said that it would be easy to obtain. Thus although use varied greatly (annual prevalence was 51 percent in 1979 and 22 percent in 1992), availability stayed consistently high. The ready availability of cocaine, including crack cocaine, increased steadily for a number of years until 1989, then declined significantly; nevertheless, 55 percent of the 1990 seniors indicated that they could easily obtain cocaine and 42 percent said crack cocaine could be obtained easily—vastly more than say they have ever used these drugs. By 2000, 48 percent said they could easily obtain cocaine, and 43 percent said they could easily get crack. The clear message here is that mere availability does not appear to be closely linked to the usage levels: marijuana use continued to decline, then increase, despite its continued high level of availability. When cocaine use was dropping sharply after 1986, perceived availability actually climbed for several years, strongly suggesting that other factors explained the change (such as perceived risk and disapproval).

With respect to heroin, however, availability probably played an important role in the increase in use during the 1990s. There was a significant expansion in the world supply of heroin in the early 1990s, which had the effect of dramatically raising the purity of the heroin available on the streets. This change in drug supply and purity provided an opportunity for users to get high from heroin without having to inject it; the non-injectable forms of ingestion contributed in a major way to the subsequent increase in heroin use.

We should also note that fluctuations in price can also play a role in influencing trends. Even though the perceived availability of marijuana remained high throughout the 1980s and 1990s, price fluctuations appear to have contributed to at least some of the observed trends in use (Pacula et al., 2001).

Since supply reduction has long been a major part of the federal strategy for drug abuse control (White paper, 1975), any indicators that may reflect the success or failure of that strategy are clearly useful for policy purposes. Indicators of marijuana and cocaine availability, and even heroin availability, suggest that the stepped-up interdiction efforts of the 1980s were not particularly successful, at least among the nation's high school seniors. We have called this to the attention of the public and national policymakers through our press releases, annual monographs, policy papers, interviews with the media, etc. Certainly surveys of consumers and potential consumers provide a valuable supplement to the existing system of indicators. Furthermore, having such data on individuals from eighth grade through young adulthood will permit the investigation of which young people in what environments acquire access to illicit drugs—an intriguing and highly researchable question.

Objective 1j: To continue to monitor the social and physical contexts in which drugs are being used by young people (i.e., when, where, and with whom drugs are used).

The social contexts and situations in which the various drugs are used is an important perspective from which to gain an understanding of the functions of drug use (e.g., Elliott, 1993; Harford & Grant, 1987; Jessor & Jessor, 1977). Obviously, if a drug is used primarily when the respondent is alone, it is not being used to facilitate social interaction. Conversely, if it is used primarily at parties and other social situations, it is probably not being used to deal with chronic anxiety or depression.

One of the six questionnaire forms used with high school seniors delves into the social contexts of drug use. For each class of drug it contains a set of questions, addressed to those reporting any use of that drug in the previous 12 months, which ask about social context and setting. They ask what proportion of usage occasions were when the respondent was alone, with just one or two people, at a party, in the presence of a date or spouse, in the presence of people over 30, during the daytime, at the respondent's home, at school, and in a car.

These data were used by the Department of Education in its publication, *What Works: Schools Without Drugs* (U.S. Department of Education, 1986). It pointed out that one-third of recent marijuana users in the class of 1985 had used marijuana in school. Our trend data showed that this was a substantial improvement over 1976, when nearly half of all recent users had used marijuana in school. Current data show that by 2000 the rate was down to 21 percent. More recently, the National Education Goals Panel has used these and some newer measures of use at school to help track the progress of the nation's schools in dealing with drugs.

Such information permits us to characterize types of users more accurately and to describe some of the social contexts in which each class of drug may be used. It also permits us to monitor the extent to which drug use occurs outside of the observation of adults. Finally, using the longitudinal panels, the extent of use in different social or physical settings in various major post-high school environments (college, military, civilian employment, etc.) can be examined.

Objective 1k: To continue to monitor the reasons that young people give for their use of the various drugs, for abstention, and for discontinuation of use.

Self-reported reasons for use of a given drug, and the anticipated function of the given drug, are thought to be critical to understanding the onset and maintenance of drug use (e.g., Bauman, 1980; Goldman, DelBoca & Darkes, 1999; Harford & Grant, 1987; Hesselbrock, O'Brien, Weinstein, & Carter-Menedez, 1987; Jessor & Jessor, 1977; Johnston, 1991a; Maggs & Schulenberg, 1998). Monitoring the Future has incorporated into one questionnaire form for high school seniors a standard list of reasons-for-use to be checked, when relevant, for each class of drugs. Thus it is possible to construct a profile of reasons for use of each drug, including alcohol, which can be compared across drugs at one point in time, across cohorts on a drug-by-drug basis, and across longitudinal intervals. Such studies of the many reasons for use of different drugs require large representative samples. We have published one extensive article based on cross-sectional and cross-time trend analyses of these variables (Johnston & O'Malley, 1986). In general, we found that reasons for drug use clustered into (a) those related to social-recreational purposes (e.g., "to have a good time with my friends," "to get high"), (b) those related to psychological-coping purposes (e.g., "to get away from my problems," "to get through the day"), (c) simple experimentation based on curiosity, and (d) instrumental motives ("to stay awake," "to lose weight"). The profile of reasons varied from drug to drug, arguing against a unidimensional or monolithic view of drug use from the adolescent's perspective. Illustrating the study's capacity to monitor qualitative as well as quantitative shifts in substance use, one finding showed that the number and percent of daily alcohol users who mention psychological-coping reasons for their use had been rising steadily over the years. Another cross-time trend indicated that amphetamines had become used more for instrumental and coping reasons than for social-recreational reasons. We will continue to look for historical shifts in the reasons young

people give for their drug use, and we also can use these measures to define qualitatively different subgroups of users to see if they differ in other respects.

As successive class cohorts pass into adulthood and progress into their 30s and 40s, it is possible to monitor whether levels of illicit drug use will continue into the adult years or whether they will decrease or be discontinued. Some measures relevant to the cessation or reduction of use also are contained in our instruments. One set asks whether, for each of a list of drug classes, the respondent personally feels that he or she should cut down or stop using the drugs. Another set of questions asks whether the respondent feels that his or her use of various drugs has caused problems of a number of types; insofar as experiencing these problems predicts the reduction or cessation of drug use, we have inferential evidence of the reasons for cessation and/or reduction.

In the specific case of marijuana and cocaine, respondents are asked explicitly which of a list of factors contributed to their either abstaining from or quitting use. Over the years some interesting shifts have occurred in the reasons given for *not* using marijuana. Between 1976 and 1990, among those seniors who had abstained from or quit marijuana use, there were significant increases in the proportions citing concern about the following: psychological consequences (up 14 percentage points to 69 percent); physical consequences (up 16 percentage points to 70 percent); becoming addicted (up 23 percentage points to 58 percent); loss of control (up 14 percentage points to 54 percent); and loss of energy or ambition (up 10 percentage points to 38 percent). In fact, early observation of these trends provided important data indicating that perceived risk indeed has a causal influence on actual drug-using behavior (Johnston, 1985). All of these changes were progressive and consistent across a number of years, although they leveled in the latter part of that period.

In 2000, as in most previous years, among the leading reasons for abstention, out of a list of 17 possible reasons, were "concern about possible psychological damage" (endorsed by 57 percent) and "concern about possible physical damage" (54 percent). Probably because these concerns have been in decline in recent years, they were inched out by "don't feel like getting high" (64 percent). Lack of availability is dead last at 6 percent, followed by "too expensive" (and "might have a bad trip") at 24 percent. These data, in combination with the availability data, strongly suggest that supply-side efforts have been particularly ineffective in controlling marijuana use and that demand-side factors predominate.

Because these reasons for refraining from or discontinuing use of marijuana are important for the understanding of both the epidemiology and prevention of drug use, and because it appears that decisions to use or not use marijuana typically occur long before the senior year, we also began asking some of these questions in the eighth and tenth grade surveys in 1991. The pattern of responses is generally similar to that for the twelfth grade. In 2000, "not available" ranked lowest, followed by "too expensive," just as for the twelfth grade. One exception is that "my parents would disapprove" was in the top five reasons for both eighth and tenth graders, though it ranked only seventh for twelfth graders. "Concern about psychological damage" was not in the top five for eighth and tenth graders; it ranked sixth or seventh.

Starting in 1989, we began to monitor reasons for refraining from or for discontinuing use of cocaine among the seniors. (From 1989 to 1996 the questions were asked separately for both powder cocaine and crack cocaine; the answers were highly similar, so we dropped the

crack cocaine set in 1997.) The answers given by the class of 2000 are informative. First they rate quite a number of reasons as "very important" in explaining their non-use of powder cocaine. The three reasons most often cited are concern about becoming addicted, concern about physical health, and concern about psychological damage. From 81 percent to 83 percent of the non-users rated these reasons as very important. Lack of availability ranked last on the list of reasons (34 percent), although 59 percent of the non-users rated "too expensive" as a reason. These data have important policy implications and are critical to understanding the etiology and prevention of illicit drug use.

Objective 2: To continue to monitor and study these same drug-using behaviors and potential explanatory variables among nationally representative samples of young adult high school graduates (modal ages 19 through 30), including the critical segment that is a nationally representative sample of American college students.

We have been following randomly selected samples from each senior year cohort since 1976. By 1980, enough follow-up years had accrued to characterize young people one to four years past high school, which included a large number of college students. Thus, we have been able to report annual data on the prevalence and trends of drug use and related factors among college students since 1980. It was not until 1986 that we had a sample encompassing ten years post-high school (modal ages 19-28), which we judged to be adequate to begin routinely reporting trend data.

Some time ago we concluded that age 32 (corresponding to the seventh follow-up after graduation from high school) represented a reasonable point to stop the biennial surveys of young adults and to shift to a five-year cycle of continuing follow-up surveys beginning at age 35 (see Objective 3). Continuing the panels in this way allowed us to cover the seldom-studied middle adulthood years (age 35, 40, 45), and to extend the age range covered in the cohort sequential analyses, at a lower cost and with less respondent burden. We have been able to make good use of the follow-up of 19- to 32-year-olds, because these are the years of higher education, military service, job attainment, family formation and (unfortunately) dissolution, pregnancy, childbearing, and so on. Continuing the coverage of the panels through age 32 allowed us to encompass enough of such events that they could be meaningfully studied. (See particularly Bachman et al., 1997a, 2002). Although coverage through age 32 initially proved useful, we have nevertheless concluded that stopping the biennial surveys at age 30 would not be detrimental in any important way, and would allow for some cost-saving. Thus, beginning with the follow-up surveys in 2002, biennial surveys are conducted through age 29 or 30, with the next survey occurring at age 35 (and at five-year intervals thereafter).

Monitoring the various social indicators concerning licit and illicit drug among young adults generally, and among college students in particular, has provided valuable additional information on prevalence and trends. This monitoring has been reported in a series of annual volumes, the latest of which is Johnston, et al., 2001b. Generally speaking, during the 1980s and into the early 1990s, annual and monthly use rates, and their trends, were not very different among the post-high school age groups and among high school seniors. However, there were some important exceptions: First, levels of cocaine use were strikingly higher for the older groups. For example, in 1990 lifetime prevalence was roughly 41 percent by age 32 compared to 9 percent among high school seniors; annual prevalence of cocaine use was about 9 percent

among those 1 to 14 years beyond high school, compared to 5 percent for high school seniors. Lifetime prevalence differences persisted through the 1990s, and in 2000 lifetime prevalence was 30 percent at age 32, compared to 10 percent among seniors. Annual prevalence (which can change more quickly than lifetime prevalence), however, had actually reversed with 6 percent use among seniors and 5 percent among those 1 to 14 years beyond high school.

Second, cigarette use showed an unusual pattern in relation to age: Current smoking increased moderately with age, but heavy daily smoking increased much more so, reflecting the fact that relatively few new smokers are recruited after age 18, but many who were moderate smokers move into a pattern of heavier consumption during the first one or two years after high school. This pattern can have important implications for prevention efforts.

Another way in which these follow-ups are vital to accomplishing the objectives of the study will become clear under the discussion of Objective 4, dealing with the separation of period, age, and cohort effects. Without the larger age band made available for study by the follow-up surveys, we would not have sufficient data to make these distinctions, which have proven to be very important. One example of a cohort effect that we were able to identify, because we simultaneously monitor adolescents and young adults, was the upturn in the use of marijuana and other illicit drugs that occurred in the early 1990s. It was observable mainly in adolescence, not in young adulthood (Johnston et al., 2001b). This unusual pattern of change points directly to educational and socializing factors as the likely causes of these upturns—a conclusion that has guided our search for explanatory factors.

Almost as a byproduct of the follow-up design, Monitoring the Future generates an excellent national sample of college students every year; this sample is better in many ways than a more typical design that first samples colleges and then samples students within them, because in the present sample the students are not clustered in a limited number of colleges. For trend estimation purposes, we have limited the age band to the most typical one for college attendance—one to four years past high school, corresponding to the modal ages of 19 to 22 years old. According to statistics from the United States Bureau of the Census, this age range encompassed about 68 percent of all undergraduate college students enrolled in college full-time in 1998 (down from 79 percent in 1989). While extending the age band an additional two years would have covered 78 percent of all enrolled college students, it also would have reduced by two years the interval over which we could report trend data. However, we determined in an early look at the data, that the differences that would have resulted in the 1985 prevalence estimates under the two definitions were extremely small. Based on 1985 estimates, the annual prevalence of all drugs except cocaine would have shifted only about one- or two-tenths of a percent. Cocaine, which has the greatest amount of change with age, would have had an annual prevalence rate only 0.8 percent higher if the six-year age span had been covered rather than the four-year age span. Thus, for purposes of estimating all prevalence rates except lifetime prevalence, the four-year and six-year intervals are nearly interchangeable.

On the positive side, controlling the age band with four-year or six-year intervals may be desirable for trend estimation purposes in part because the age composition of college students is changing with time. Otherwise "college students" characterized in one year would represent a non-comparable segment of the total population when compared with college students surveyed in another year.

College students are explicitly defined as those follow-up respondents one to four years past high school who say they were registered as full-time students at the beginning of March in the year in question *and* who say they are enrolled in a two- or four-year college. Thus, the definition encompasses only those who are one to four years past high school and are active full-time undergraduate college students in the year in question. It excludes those who may previously have been college students or already may have completed college.

The college student population, however defined, is an important one to be studying and monitoring for several reasons. Obviously, because of the selection process involved in admission to college, this population is not likely to hold a particularly large proportion of the addicts this age. It is useful to note, however, that there have not generally been great differences in drug use found between the college population and those classmates the same age not attending college (Johnston et al., 2001b). And, while the college students' cigarette smoking rates have been distinctly lower than their non-college counterparts (clearly a selection effect), their binge drinking rates have been much higher (not a selection effect) (e.g., Schulenberg et al., 2000; see also Bachman et al., 1997a). So college students are of interest in their own right, both because they represent a population of particular importance for the future leadership of the country *and* because some important changes in substance use occur during the college years. Also, they are in a young adult segment of the population in institutions that are able and willing to adopt policies and programs aimed at prevention. But in the larger context of understanding national epidemics of drug use, college students are important simply as forerunners of change that will be occurring in the society at large. Recall that the broad epidemic of illicit drug use of the late twentieth century began on the American college campus, before spreading outward and downward in the age spectrum. More recently, it appears that the spread of MDMA, or ecstasy, first occurred in the college population, although it has since spread and become more prevalent off campus (Johnston et al., 2001b).

As has been mentioned, the resurgence of the broad drug epidemic in the early 1990s evolved primarily in adolescence, but this will not always be the case. Thus, keeping our finger on the pulse of America's college students may provide both forewarning of new problems and greater knowledge of the epidemiological dynamics of those new problems.

In addition to having an excellent national sample of college students, Monitoring the Future also generates an equally important representative sample of young adults who complete high school but do not attend college. The noncollege-attenders have been referred to as "the forgotten half" (William T. Grant Foundation, 1988), largely because so much less is generally known about them than about those who attend college. Typically, they are more difficult to study than "captive groups" of college students.

In addition to the obvious benefits regarding our understanding of the epidemiology of drug use, our panel data on young adults provide many advantages for understanding the etiology and prevention of drug use (cf. Rutter, 1988; Schulenberg, Maggs, Steinman, & Zucker, 2001). In particular, we have been able to track the same individuals before, during, and after the transition to young adulthood, one of the most critical developmental transitions in the life course (e.g., Arnett, 2000; Petersen & Ebata, 1987). At the same time, with the cohort-sequential design, we have several panel samples that provide, among other things, important evidence regarding any true developmental trends (e.g., Elliott et al., 1989; Schulenberg et al., 2000).

Objective 3: To monitor and study longer-term patterns and consequences of drug use beyond young adulthood by continuing to conduct follow-up surveys at ages 35 and 40, and by initiating follow-up surveys at age 45.

The follow-up panels have become increasingly valuable, as the biennial series of surveys of drug use and other experiences has extended to cover all of young adulthood. However, the pace of age-related change in drug use and related attitudes and behaviors tends to slow as respondents approach their mid-30s. Many of the issues and experiences relevant for high school seniors and young adults become less central, and new issues and experiences emerge. Accordingly, after the sixth scheduled follow-up for each graduating class, the follow-up procedures shift in two important ways: First, we shift to a 5-year interval between follow-ups (modal ages of 35 and 40; we are proposing to continue this schedule, adding an age 45 survey). Second, the questionnaire content is different from the earlier follow-ups, with many (mostly non-drug) items being eliminated, and some new, more extensive measures of key events and experiences that mark the movement beyond young adulthood being added. In particular, we wanted to capture a broader array of adulthood experiences (e.g., concerning family relations and parenting practices) and of drug behavior and attitudes (e.g., drug abuse and dependency, views on adolescent drug use). Also, a single questionnaire form is used instead of six forms.

As detailed below, there are numerous benefits of continuing to follow the MTF respondents as they enter new segments of the life-span, and these age 35, 40, and 45 follow-ups are intended as a reduced-cost and reduced-burden strategy for realizing these benefits. The age 35 survey was first implemented in 1993-94, beginning with the 1976 senior year cohort, and has continued annually with the subsequent senior year cohorts. The age 40 survey, started in 1998, again began with the 1976 senior year cohort. In addition, we are proposing to initiate an annual age 45 survey, starting in 2003 with the 1976 senior year cohort.

These follow-ups extend the age spectrum within which we can differentiate age, period, and cohort effects (see Objective 4 discussed below) and, in particular, over which we can examine life course development (Objective 6). The fact that these older panels have become the parents of the generation of adolescents now being surveyed in the study makes them a valuable source of information on parental attitudes and behaviors, as well as on generational change. Although we do not have data matching parents with their own children, the monitoring of drug use and related behaviors and attitudes among adjacent generations provides additional important opportunities for describing and explaining aggregate change (Objective 5), and ultimately for understanding and addressing societal drug epidemics (cf. Johnston, 1991a).

We conceptualized the mid-30s as an important post-transitional period, a point at which the large majority of individuals have established their occupational and familial paths. Over the past decade, there has been an increase in conceptualization and research concerning middle adulthood (e.g., see the edited volume by Willis and Reid, 1999, for an overview of research issues and findings regarding middle adulthood), in part because of increased interest in development across the whole life span, and in part because longitudinal projects (such as ours) have continued on, following respondents beyond young adulthood. The significance of moving beyond young adulthood rests in part on the individual's increased investments in the "status quo" and in the younger generation. According to Erikson's (1963) life-span theory of

psychosocial development, after the identity and intimacy quests of adolescence and young adulthood comes the generativity quest of early to middle adulthood. Generativity, which can be defined as "a configuration of psychosocial features constellated around the goal of providing for the next generation" (McAdams, de St. Aubin, & Logan, 1993, p. 221), can take many forms, including parenting efforts as well as occupationally and community relevant ones (e.g., Peterson & Stewart, 1993). There is evidence to suggest that feelings of, and efforts toward, generativity increase after young adulthood (e.g., McAdams et al., 1993; Ryff & Heincke, 1983), and the individual and societal significance of increased orientation toward generativity during adulthood is clear. Thus, as the MTF respondents approach and experience the unique and consequential experiences of middle adulthood, we believe it is a critical time to conduct an in-depth examination of (a) the impact of adulthood roles and experiences on changes in drug use and (b) the consequences of earlier substance use on these roles and experiences, as well as on adulthood health, substance use, abuse, and dependence.

The age 35, 40, and 45 surveys provide additional and important vantage points from which to examine the relationship of transitions in social environments and roles to changes in drug use (adding to Objective 6b discussed below). For example, while we have found that the impact of parenthood by itself does not have a large unique impact on drug use during young adulthood (Bachman et al., 1997a, 1997b), we may find that this conclusion is qualified when the respondents' children approach and enter adolescence. In particular, in facing the specter of their own children's potential drug use, those respondents still using illicit (and licit) drugs may well decide to quit or alter their use patterns. In contrast, because well-being and marital satisfaction among parents may decline somewhat as their children make the transition into adolescence (e.g., Silverberg & Steinberg, 1990; Steinberg & Silverberg, 1987), the parents' coping capacities may become strained, and we may see instead increases in substance use among parents (including alcohol use and perhaps the inappropriate use of prescription drugs). Furthermore, concerning the intergenerational transmission of substance use behaviors and attitudes, it is informative to consider how disapproval of teenage substance use may vary among parents as a function of the age of their children. Indeed, we have found that disapproval of teenage substance use is higher among parents whose oldest child is 10 to 17 than among parents whose oldest child is 9 or younger (Merline, Schulenberg, & O'Malley, 2001).

Similarly, although our previous research indicates that early occupational transitions may not have a strong relationship with changes in drug use during young adulthood, we may find that, as individuals move into more responsible positions and become more invested in their careers, they decide they have too much to lose and thus cease their use of illicit drugs rather than risk discovery. For example, while we have not yet determined the extent to which it reflects selection or socialization effects, we have found that respondents occupying professional positions (at age 35) are less likely to smoke, drink heavily, use marijuana or use cocaine (Merline, O'Malley, Schulenberg, Johnston, & Bachman, submitted). Conversely, the pressures of higher level occupations, for some, may well contribute to increased substance use, and a similar case can be made for the effects of role overload (e.g., increased work pressure *and* increased family obligations from older and younger generations) on substance use. In analyses thus far, we have found that use of psychoactive substances—in particular marijuana, cocaine, and heavy drinking of alcohol—tends to move in a parallel or similar fashion. For example, all three measures showed increases after high school, and later declines (secular trends complicate the picture, but there appear to be clear developmental patterns as well). If in fact there are

pressures that tend to produce increases in substance use, and pressures to avoid use of illicit drugs, then we may see a divergence between use of alcohol (or prescription psychotherapeutic drugs), on the one hand, and illicit drugs such as marijuana or cocaine, on the other.

While middle adulthood is not typically viewed as a prime period in the life span for illicit drug abuse, it must be remembered that this view is based on previous cohorts who do not have a history of extensive drug use in their youth. Some of the respondents in the cohorts now entering middle adulthood and facing the unique pressures associated with this period, as well as beginning to experience what is commonly referred to as "mid-life crisis," may find themselves reverting to past strategies (including drug use) to cope with pressure. We plan to examine these and other issues concerning the relations between changes in drug use and social roles and environments during early and middle adulthood, using a variety of analytic techniques to exploit more fully the panel data (e.g., regression analyses and structural equation modeling with latent variables to examine predictive models and causal links; latent growth and growth mixture modeling to examine the course and patterns of change over time). In addition, in the middle adult surveys, we gather new information about the respondents' own views about why they stopped or reduced their drug use (contributing to Objective 1k discussed above), as well as about drug dependence (in accordance with Objective 8 discussed below), thus permitting additional strategies for understanding how and why drug use changes during adulthood.

With regard to consequences of drug use, the inclusion of the age 35, 40, and 45 surveys provide us with additional "endpoints" for which to consider the potential consequences of adolescent and young adult drug use (strengthening our efforts regarding Objective 7). Not only does this permit us to consider possible "sleeper effects" (i.e., it may take many years and/or the unique experiences of entering middle adulthood for the effects of earlier drug use on health and well-being to become manifest), but also the age 35, 40, and 45 surveys will permit us to examine a wider range of longer-term social and health consequences. For example, when investigating consequences of adolescent and young adult substance use, the outcomes of interest are often fairly short-term in nature (e.g., school grades or dropping out, car accidents caused by intoxicated driving); in contrast, middle adulthood provides us with an opportunity to view the *cumulative* effects of substance use on physical health (e.g., self-reported heart disease and high blood pressure). Furthermore, in addition to gathering information on drug *abuse* (which we also obtain in the young adult follow-up surveys), we gather some information regarding drug *dependence*, which will allow us to examine this as a consequence of earlier drug use (again, contributing to Objectives 7 and also 8, as discussed later). Continuing to collect data into midlife will provide us with the opportunity to examine factors that differentiate individuals with early-onset and late-onset drug abuse and dependence.

Also, given the expanded focus on marital history and parenting practices, we expect to examine these as consequences of earlier drug use. We have been examining the effects of adults' previous drug use on their views on adolescent drug use, which has important implications for the intergenerational transmission of drug use. Furthermore, we have been examining the extent to which this effect is mediated through parenting practices (Schulenberg, 2001; manuscript in preparation). There is a wealth of literature concerning the impact of parenting practices on adolescent substance use, indicating that parental monitoring and nurturance correspond with lower adolescent substance use (e.g., Ary, Duncan, Biglan, Metzler, Noell, & Smolkowski, 1999; Biglan, Duncan, Ary, & Smolkowski, 1995; Blackson & Tarter,

1994; Brook, Brook, Gordon, Whiteman, & Cohen, 1990; Brook, Kessler & Cohen, 1999; Dishion & McMahon, 1998; Johnson & Pandina, 1991; Oetting & Donnermeyer, 1998; Kumpfer & Turner, 1990; Peterson, Hawkins, Abbott, & Catalano, 1994; Schulenberg, 1996). Although we do not collect data from the adult respondents' children, we do gather data from the adults about their parenting practices and their perceptions of the behaviors and attitudes of their adolescents, which in turn can be examined as consequences of the adults' previous and current drug use (cf. Brook, Whiteman, Balka, & Cohen, 1995; Duncan, Duncan, Hops, & Stoolmiller, 1995; Kandel, 1990). These sorts of research questions are ideally suited to latent growth and growth mixture models, in which we will be able to examine the unique impact of initial (adolescent) level of drug use as well as the unique impact of the pattern of drug use during young adulthood on middle adulthood outcomes. More details about our recent efforts on examining the long-term consequences of adolescent and young adult drug use on middle adulthood functioning and adjustment are provided later when we discuss Objective 7.

Objective 4: To attempt to distinguish among three basic types of change in drug use and related factors at the aggregate level: age, period, and cohort.

This objective is one of Monitoring the Future's more important objectives in its own right. Its importance is heightened by the fact that the study is one of very few that has the complex research design necessary to address it, and also because the pursuit of a number of the other objectives in this study is influenced in important ways by the accomplishment of this objective. Distinguishing among the three types of change is useful not only in terms of general description, but also in terms of guiding the scientific search for potential causes (Glenn, 1981a; Schaie, 1994). If a secular trend or period effect is identified, the causes are likely to be broad societal forces occurring contemporaneously. If cohort effects are found, the causes are likely to be events that primarily affect certain cohorts at a particular stage in the life cycle. Because a cohort effect may become evident only after some lapse of time, a search for the historical forces responsible for the observed change must extend to earlier time periods in the life cycle of the cohort(s). And if age effects are found consistently across a number of cohorts, then they likely reflect contemporaneous experiences particular to the developmental stage through which respondents are passing, largely because such experiences (e.g., marriage, parenthood, employment) tend to occur for all cohorts at roughly the same age.

If a change is misidentified as to whether it reflects a period, age, or cohort effect, then the search for causes and appropriate interventions is likely to focus on the wrong class of variables, and quite possibly on the wrong historical period. Therefore, distinguishing among age, period, and cohort effects with considerable accuracy has significance not only for the causal searches that we conduct, but also for those conducted by other researchers.

In one of NIDA's earliest research monographs, in a discussion about gaps and future directions in drug epidemiology, William McGlothlin stated, "measures of trends, collected in a standard fashion and reported on a regular basis, are one of the most important aspects of drug epidemiology" (1975, p. 255). He also indicated that for broader epidemiological work, "the longitudinal study is essential" (p. 256). But, as a number of investigators have indicated, simple longitudinal studies are not adequate for the demanding task of understanding change in drug use. Schaie wrote in 1965, "the conventional longitudinal and cross-sectional methods for the study of developmental problems can lead to comparable results only when there are

no...cultural changes in relation to the variables studied. . . . Research strategies are required, therefore, which will permit the unconfounding of the components of developmental change" (p. 106).

In a similar vein, Baltes and Nesselroade in 1972 wrote, "Present cultural change . . . appears so rapid and pervasive that results from particular cross-sectional or longitudinal studies are threatened with obsolescence before they can be marketed to the scientific consumer" (p. 244). Speaking of their own findings about cultural change and personality development based on one of the few multi-cohort designs in the literature, they went on to say, "In our judgment, the study presents convincing evidence that cohort differences play a major role in the development of adolescent personality. . . The present results suggest that the average standing of adolescents on personality dimensions is less dependent on their chronological age than upon the time (cultural moment) at which they are measured" (pp. 253-254).

The cohort-sequential design—that is, one in which "longitudinal sequences for two or more cohorts are examined simultaneously" (Schaie, 1965, p. 97)—has the potential for addressing all of the needs stated above. It quantifies trends by taking measurements in a standard fashion and on a repeated, regular basis; it provides longitudinal studies of multiple cohorts; and it further provides the database from which regular maturational changes, period effects (changes observed in all cohorts and ages), and cohort-specific changes can begin to be disentangled. These efforts at disentangling can be applied not only to observed changes in drug use, but also to changes in attitudes, beliefs, and even relationships with other variables (such as delinquency or a counter-culture orientation).

Attempts to distinguish among age, period, and cohort effects are usually difficult, and often controversial, because of the inherent confounding among the three "independent" variables. Because any two of the three variables defines the third, there are only two statistically independent effects possible, even though conceptually there are three potentially different factors operating. The analytic methodology is consequently complex. However, it is sometimes possible to discern rather clearly what is happening by inspection of the data (Weinkam & Sterling, 1991). The era from the mid-1960s to the present has been an exceptionally turbulent time in the nation's history with regard to drug use; as a result, there have been substantial secular trends observed for nearly all drugs. For some years, the secular trends were discernible from the parallel trend lines for multiple age groups over certain historical periods, as are displayed in a number of figures in our annual NIDA-published monographs (Johnston et al., 2001b, and earlier volumes in that series). Similarly, cohort effects may be fairly obvious from such graphs, as was true in the case of cigarettes over much of the life of the study, and as has been true for marijuana use in the period from about 1992 to 1996.

In the 1990s, we reported cohort effects for most of the illicit drugs for the first time during the life of the study (with the single exception of daily marijuana use), as the use of many of these drugs began to rise sharply among adolescents but not among young adults or older adults (Johnston, et al., 2001a). It is clear that something had changed in the culture that was uniquely affecting young people during that historical period, and we discuss under the next objective what some of our hypotheses have been to explain this unusual development.

Sometimes it is necessary to conduct more rigorous kinds of analyses in order to distinguish and quantify the various types of change that may be going on simultaneously. In the 25-year period between 1965 and 1990 there were a number of publications advocating or criticizing various ways to analyze cohort-sequential data of the kind that Monitoring the Future has been collecting (Adam, 1978; Buss, 1973, 1975; Converse, 1977; Costa & McCrae, 1982; Ferrara, 1990; Fienberg & Mason, 1979; Glenn, 1977, 1981a, 1981b; Labouvie, 1975; Maddox & Wiley, 1976; Mason & Fienberg, 1985; Mason, Mason, Winsborough, & Poole, 1973; Menard, 1992; Osmond & Gardner, 1989; Palmore, 1978; Pullum, 1978; Rodgers, 1982a, 1982b; Schaie, 1965, 1984; Smith, Mason, & Fienberg, 1982; Williams, 1991). One general conclusion that emerged was that cohort analysis was a useful, perhaps necessary, first step, but that a full understanding of the dynamics of change would require the introduction of additional variables to the analysis. This understanding has continued in the interval since 1990, as exemplified in Johnson & Gerstein (2000) and Kandel, Griesler, et al. (2001).

Our own first effort at formally differentiating period, age, and cohort effects was published in the *American Journal of Public Health* in 1984, and an updated effort was published in the same journal in 1988 (O'Malley, Bachman, & Johnston, 1984, 1988). The analyses displayed quite an impressive variety of change patterns observed among the different drugs in the relatively short interval between 1976 and 1988. Several kinds of *period* effects were evident. Marijuana use increased through 1979, decreasing thereafter. Cocaine use increased through 1980, was constant until 1986, then declined. Alcohol use declined (monthly prevalence and occasions of heavy drinking).

Increases with *age* in the early years after high school were seen for all measures of cigarette use. The different patterns indicated that there was not much increase in the proportion who were active smokers in the years after high school, but that among those who smoked, a higher proportion became frequent smokers. Alcohol use and annual prevalence of cocaine increased linearly with age through age 21 and declined thereafter. A measure of occasions of heavy drinking showed a similar increase through age 21, but declined thereafter. Annual and monthly marijuana prevalence followed a similar pattern, peaking at age 21 or 22 and declining thereafter.

Clear *cohort* effects (in this case high school class cohort) appeared for cigarette use, with successive classes smoking less at all levels, though there may be an important slowing down occurring. There may also be small cohort effects for daily marijuana use and daily alcohol use (both measures of use seemed to be declining with successive classes).

We expect to continue these efforts at differentiating among period, age, and cohort effects, but we also are engaged in continuing efforts to understand the causal processes underlying observed changes. As we indicated earlier:

> The documentation of these various effects by use of a cohort-sequential design is but one step in the scientific process. It provides a more refined description of a phenomenon, by separating observed changes into several qualitatively different component parts. The next step is the explanation of those component parts, and this requires an analysis of all the causal factors for which year, age, and class are proxies. . . . Having a good understanding as to which type of effect accounts for

> observed change should greatly enhance our ability to focus on the appropriate classes of explanatory variables. (O'Malley et al., 1984, 688)

Objective 5: To attempt to explain, at the aggregate level of analysis, secular trends and lasting cohort differences in drug use, emphasizing changes in cultural influences, attitudes, beliefs, value orientations, price, and availability as possible explanators.

As indicated in Objective 4, the documentation of any of the three types of change is a first step. The more scientifically interesting enterprise is to determine what factors have been responsible for effecting each type of change identified. The three basic types of change involve different dynamics, and one would expect quite different causal factors to be operating to produce these various types of change.

In terms of explaining aggregate change, the study has contributed to the knowledge base in a number of ways. In examining change over time, we have attempted to distinguish historical or secular change (common to most age groups), from age-associated change (common to most cohorts), from lasting differences between and among cohorts (observable across age). As we discussed earlier, a correct distinction among these alternatives is key to the development of an understanding of *when the change occurred* and the *types of explanatory variables* likely to account for the change. The study has found and reported all three types of change across the various drugs under study, and has offered and demonstrated explanatory factors for each of the three types of change (e.g., Bachman et al., 1997a; Johnston, et al., 2001a and earlier volumes in the same series; O'Malley et al., 1984, 1988; Schulenberg et al., 2000).

In particular, the findings that secular trends in drug use over the past 25 years can be explained by demand-side factors (such as attitudes, beliefs, and peer norms) and cannot be very well-explained by supply-side factors (such as perceived availability) have policy implications of the broadest order. The fact that cigarette smoking shows strong and lasting cohort-related differences, beginning by early adolescence, has proven critical to policy considerations with regard to that behavior. (A number of other findings from the study regarding smoking also have proven critical to policy considerations.)

Although supply-side factors could not explain secular trends as well as demand-side factors, that does not mean that supply factors are not important. Price is likely to be one important factor in determining use of drugs, and MTF data were instrumental in providing some empirical support for the role of price in affecting use of marijuana (Pacula et al., 2001). A problem with attempting to assess the role of price in determining use is that there are no very good measures of price. Moreover, the potency (or purity) of substances like marijuana, cocaine, and heroin have changed substantially over the last 25 years, and these changes should be taken into account in assessing the real price or price per "high," although adequate measurement of these factors often are lacking. Accessibility of substances is also likely to be an important factor in determining use. Although changes in accessibility, or perceived availability, of marijuana and cocaine did not appear to explain much of the changes in use of those drugs, it may be that increased efforts at restricting access to tobacco for young adolescents will have some salutary effect, perhaps as much from the symbolism of that action as the actual interruption of accessibility.

One particular change that we were able to identify as being primarily a secular trend (and not a cohort effect or age effect) was the change between 1979 and about 1990 in marijuana use. In the particular case of marijuana use, and in the more specific case of daily marijuana use, we concluded that much of the explanation was due to related attitudes; specifically, perceived risk of harm of regular marijuana use and personal disapproval of regular marijuana use. We arrived at this interpretation after evidence of their temporal covariation cumulated (Johnston, 1982, 1985; Johnston, O'Malley, & Bachman, 1984, 1991), and after careful consideration of various other possibilities, as detailed in Bachman, Johnston, O'Malley, and Humphrey (1986).

A similar secular trend occurred with respect to cocaine use in the latter half of the 1980s—a decline that occurred in multiple age groups in the same time interval. Again, we concluded that much of the explanation was due to perceived risk of harm, this time the risk associated with cocaine use, even occasional use. We documented the bases for the conclusion in some detail in Bachman, Johnston, and O'Malley (1990a). And Johnston (1991a) pointed out that the changed belief translated into changed behavior only when the belief was relevant to the type of behavior in which the respondents were likely to engage (i.e., experimental or occasional use of cocaine). This finding is quite consistent with the Health Belief Model.

Another change occurred in cigarette smoking: there appeared to be a clear cohort effect, at least through the class of 1986, wherein each successive class smoked at lower rates than the preceding class. We attributed the effect, in large part, to the addictive properties of cigarette smoking. If, for whatever reasons, a given age cohort achieved a different rate of smoking at a given age compared to earlier age cohorts, that difference would persist. The question of what caused a different rate to occur is one that is clearly of great scientific interest; the identification of the effect as a cohort effect helps suggest what kinds of variables should be examined. In this specific case, the reduction in advertising of cigarettes on television and radio, which occurred in 1971, could be implicated. Earlier cohorts (the senior classes of 1975 to 1977, born in 1957 to 1959) were exposed to explicit modeling of smoking behaviors in advertising when they were at the impressionable ages of 10 to 13. Later cohorts might have been less inclined to initiate smoking because there was less explicit modeling of the behavior. Such a process would be expected to generate a cohort effect, if one assumes that the behavior will persevere, once initiated. More recent cohorts (through the mid- to late 1980s) showed rather little decline. The great increase in advertising in the print media and various forms of promotion since the mid-1970s has been suggested by us as one possible reason for the lack of further decline in smoking (Johnston, 1985) and for the subsequent increases in smoking after 1991 (Johnston et al., 2001b). Whatever the factors, the identification of a clear cohort effect improves the chances of making proper scientific inferences about the operative causal factors, in part because it guides the search for relevant factors to an earlier historical period rather than the period that might be considered if a secular trend were assumed.

During the early and mid-1990s, marijuana use increased, particularly among young Americans. We attribute this increase to a cohort effect because the increase was seen primarily among adolescents rather than among young adults. In fact, the study showed that the turnaround started first among the eighth graders (in 1991). This unusual overall pattern of change strongly suggested that the educating and socializing influences that reached earlier cohorts were not reaching more recent cohorts of children. MTF documented that the perceived risk of various drugs declined during the mid- and late 1990s at each grade level. These findings have led to an

expansion of our theoretical approach by positing "generational forgetting" of the dangers of drugs. We believe that generational forgetting can be a predictable and important cause of a relapse phase in an epidemic. (Generational forgetting simply means that young people today do not know or appreciate the consequences of drug use to the extent that their predecessors did—that such knowledge has not been maintained across cohorts.)

In interpreting the increases in use, we offered a number of explanatory hypotheses (usually with some substantiating evidence):

(1) There was less chance for vicarious learning from observing the consequences suffered by users, because there were so many fewer users in recent years.

(2) Young people in recent years heard many fewer cautions about drug use (national news coverage of the issue dropped over 90 percent between 1989 and 1994; advertisement placements by the Partnership for a Drug-Free America (PFDA) dropped by about 25 percent over the same interval; and federal funding for Drug-Free Schools and Communities declined by 40-50 percent between 1992 and 1995, after adjustments for inflation).

(3) Parents from the drug generation were discussing drugs less with their children (surveys conducted for the PDFA provided these data), perhaps because they felt hypocritical telling their children not to do what they themselves did.

(4) There was some "re-glamorizing" of drugs (data collected by the PFDA indicate there had been a rise in pro-drug lyrics and modeling by rock stars, and unpublished data from the MTF study showed that teens *perceived* a large and growing use of illicit drugs among key role model groups—particularly rock musicians).

(5) The rise in the number of teens smoking cigarettes may have contributed to the rise in the number using marijuana, because these two behaviors are strongly and sequentially associated.

If these interpretations are correct, the implications for prevention are dramatic. Because the informal sources of learning are diminished after a major downturn in use, compounded by society dropping its attention to the issue, the need for planned and systematic teaching about the consequences of drug use becomes greater if a newer and more naive generation of young people are to be spared their own epidemic. Put a different way, after each period of substantial decline, the seeds of a new epidemic are sown (absent any planned intervention), because the hazards of drugs are forgotten; and after each expansion of an epidemic, the seeds of the next decline are sown because the hazards will again become visible.

The third kind of effect is developmental, which deals with individual changes as opposed to aggregate group changes. Developmental effects will be discussed later, primarily under Objective 6.

Objective 6: To examine at the individual level of analysis the natural history of drug use and related factors from early adolescence through middle adulthood, and to attempt to explain age and social role effects on the initiation, maintenance, and cessation of drug use.

This study continues to describe and attempt to explain the developmental course of drug use from adolescence through young adulthood. Recently, we extended the coverage through middle adulthood. Our approach is conceptually and methodologically informed by relevant epidemiological, etiological, developmental psychopathology, and life-span developmental literatures, a combination that reflects a cross-disciplinary perspective increasingly advocated over the past decade or so (e.g., Brook et al., 1990; Burton, Johnson, Ritter, & Clayton, 1996; Clayton, 1992; Glantz & Hartel, 1999; Glantz & Leshner, 2000; Grant, Harford, & Grigson, 1988; Hartka & Fillmore, 1989; Kandel, 1998; Kellam & Rebok, 1992; Pandina et al., 1984; Pandina & Johnson, 1999; Schulenberg, Maggs, & Hurrelmann, 1997a; Schulenberg, Maggs, Steinman & Zucker, 2001b; Windle, 1988; Windle & Davies, 1999; Zucker, 1989, 1994). That is, within the opportunities and constraints in the ongoing Monitoring the Future project, we focus on stability and change in drug use and related factors from early adolescence through middle adulthood, and on the developmentally and contextually linked causes and correlates of initiation, maintenance, cessation, and abstinence.

Much theory development and longitudinal research over the past few decades have been devoted to understanding the course of drug use during adolescence and young adulthood as well as to determining the risk factors for, and protective factors against, such drug use. See, for example, recent edited books by Glantz and Hartel (1999), Glantz and Pickens (1992), Jessor (1998), and Kaplan (1995), and review articles by Brook and Brook (1996), Clayton (1992), Hawkins, Catalano, and Miller (1992a), Hops, Andrews, Duncan, Duncan, and Tildesley (2000), Petraitis, Flay, and Miller (1995), Schulenberg, Maggs, Steinman, and Zucker (2001b), Szapocznik and Coatsworth (1999), and Weinberg, Rahdert, Colliver, and Glantz (1998). The particular importance of these and related topics to the health and well-being of the nation's young people, as well as the conceptual and analytic complexities of the issues involved, underscore the necessity for continuing such etiological efforts. MTF contributes uniquely and significantly to these efforts. In particular, the combination of the cohort-sequential design (which permits the separation of age effects from cohort-specific and historical ones) along with large national samples makes for a close to ideal method for describing and interpreting typical developmental change in drug use, in addition to atypical patterns of change. The size of the follow-up samples, particularly when the lack of cohort and secular trend effects permits concatenation across the panels, also allows for consideration of change in important subgroups as well as some focus on heavy users (contributing to Objective 8). And the long-term multi-wave panels spanning early adolescence through middle adulthood provide an important vantage point for delineating how the various developmental transitions from childhood to adulthood influence changes in drug use (see also Objective 3).

Although the study of developmental change in drug use is one of the most exciting features of the Monitoring the Future project, we recognize that the study of developmental change is perhaps the most complex and unwieldy of endeavors within the social-behavioral sciences (e.g., Cronbach & Furby, 1970; Nesselroade, 1992; Nesselroade & Baltes, 1979). At the same time, the cohort-sequential longitudinal design of the project remains the state-of-the-art design for studying change and decomposing the various causes of change. Several recent

analytic advances (as represented in, e.g., Arminger, Clogg, & Sobel, 1995; Bryant, Windle, & West, 1997; Collins & Horn, 1991; Collins & Sayer, 2001; Gottman, 1995; Marcoulides & Schumacker, 1996; Rose, Chassin, Presson & Sherman, 2000; von Eye, 1990) have facilitated our approach to studying change.

The MTF multi-cohort national panels. The longitudinal feature of the Monitoring the Future research design has been a central part of much of our recent analyses and writing, and will surely continue to be central in the future. There are now longitudinal data on twenty-five panels from the classes of 1976 through 2000 followed into 2001. These panels have been maintained to age 31-32 with the annual data collections (i.e., seven biennial follow-up surveys—note that beginning in 2002, we will stop the biennial young adult surveys at age 30), and to ages 35, 40, and 45 (proposed) with half-decade data collections using middle adulthood surveys. New panels will be added for each future graduating class participating in the study. In addition, we continue the annual national cross-sectional surveys of eighth and tenth graders (begun in 1991), and these combined with the annual surveys of twelfth graders permit a cross-sectional examination of age differences in the correlates of drug use across the adolescent period. Furthermore, we are following random sub-samples of three cohorts of initial eighth graders (in 1991-1993) into young adulthood. These national panels permit a longitudinal consideration of risk and protective factors from early adolescence into young adulthood. The long-term aspect of the panels is one of the most important features of the longitudinal component of MTF, allowing the longer term investigation of both the etiology and consequences of drug use. As discussed below, there are several other important features of the MTF panel data.

These data comprise a rare and valuable resource: longitudinal drug data on broadly representative national and multi-cohort samples of adolescents and adults. Most of the other earlier longitudinal samples either have not been national in scope or have been less broadly representative; for example, the Youth in Transition series on the class of 1969, the O'Donnell et al. (1976; Burton et al., 1996) study, and Robins' (1978) study were all national, but contained only males. An excellent study of the epidemiology and etiology of delinquent behavior and drug use by Elliott, Huizinga, and Ageton (1985) and Elliott et al. (1989) covered comparatively fewer birth cohorts (seven) and fewer cases (about 1,725). There have been, of course, quite a number of scientifically valuable longitudinal studies focused on drug use, which have not been based on national samples, including, for example, those by Brook and colleagues (e.g., Brook, Gordon, Brook, & Brook, 1989; Brook, Kessler, & Cohen, 1999; Brook, Richter, Whiteman, & Cohen, 1999; Brook, Whiteman, Cohen, & Shapiro, 1995; Brook, Whiteman, Finch, Morejele, & Cohen, 2000; Brook, Whiteman, & Gordon, 1983); Brunswick (e.g., 1984; Brunswick, Messeri, & Titus, 1992); Ellickson and colleagues (e.g., Ellickson, Bell, & McGuigan, 1993; Ellickson, Collins, & Bell, 1999; Ellickson & Hays, 1992); Flay and colleagues (e.g., Flay et al., 1994; Petraitis, Flay, Miller, Torpy & Greiner, 1998; Richardson, Radziszewska, Dent, & Flay, 1993); Hawkins and Catalano (e.g., Catalano, Morrison, Wells, & Gillmore, 1992; Hawkins et al., 1992b; Hawkins, Guo, Hill, Battin-Pearson, & Abbott, 2001; Peterson, Hawkins, Abbott, & Catalano, 1994); Newcomb and Bentler (e.g., Newcomb, 1997; Newcomb & Bentler, 1988; Stacy, Newcomb & Bentler, 1991; Stein, Newcomb & Bentler, 1987); Jessor and colleagues (e.g., Donovan, Jessor, & Costa, 1999; Donovan, Jessor, & Jessor, 1983; Jessor, Donovan, & Costa, 1991; Jessor & Jessor, 1977); Kandel (e.g., 1984; Chen & Kandel, 1995; Kandel et al., 1990; Kandel & Yamaguchi, 1993, 1999); Kaplan (e.g., 1984; Kaplan, Peck, & Kaplan, 1997;

Kaplan & Damphousse, 1995; Johnson & Kaplan, 1991); Kellam, Anthony, Ensminger and colleagues (e.g., Chilcoat, Dishion, & Anthony, 1995; Crum, Ensminger, Ro, & McCord, 1998; Kellam et al., 1984; Kellam & Rebok, 1992); the Oregon Research Institute (e.g., Duncan, Duncan, & Hops, 1996; Duncan, Duncan, Hops, & Stoolmiller, 1995; Duncan, Tildesley, Duncan, & Hops, 1995; Hops et al., 2000); the Oregon Social Learning Center group (e.g., Dishion, Capaldi, Spracklen, & Li, 1995; Dishion & McMahon, 1998; Dishion, Patterson, Stoolmiller, & Skinner, 1991; DeBaryshe, Patterson, & Capaldi, 1993); the Rutgers Health and Human Development Project (e.g., Bates & Labouvie, 1995; Johnson & Pandina, 1991; Labouvie, Bates, & Pandina, 1997; Labouvie, Pandina, & Johnson, 1991; Pandina & Johnson, 1990, 1999; White & Bates, 1995); and Smith (e.g., Guy, Smith, & Bentler, 1994; Smith & Fogg, 1978).

Of course, many of the aims of longitudinal studies do not require representative samples from the general population, and the studies cited above provide some excellent illustrations of the power of longitudinal research. Kandel (1975), for example, identified and described a modal pattern of stages in the unfolding of drug-using behavior among American adolescents. While based on sample of two adjacent birth cohorts (tenth and eleventh graders in 1971) from a single state (New York), the findings are likely to be valid for most American youth over the last few decades. She has extended the longitudinal span of the study through young adulthood and beyond, providing considerable information on the patterns of drug use from adolescence through adulthood (e.g., Chen & Kandel, 1995; Kandel, 1988; Kandel et al., 1990; Kandel & Logan, 1984; Kandel, Simcha-Fagan, & Davies, 1986; Kandel & Yamaguchi, 1993, 1999; Kandel, Yamaguchi, & Chen, 1992; Yamaguchi & Kandel, 1984a, 1984b). Treating illicit drug use as part of a larger constellation of problem behaviors, along with such other behaviors as delinquency and early sexual experience, Jessor and Jessor (1977, 1978, 1984) through longitudinal analysis have demonstrated how illicit drug use among adolescents is part of a sequential pattern of problem behaviors, such as delinquency, rebelliousness in school, and sexual precocity. Their ongoing longitudinal research has continued to investigate the structure of problem behavior through adolescence into young adulthood (e.g., Donovan & Jessor, 1985; Jessor, Donovan, & Costa, 1991, 1996; Donovan, Jessor, & Costa, 1999). Again, although based on a sample of a few cohorts of young people in one state (Colorado), these findings seem likely to hold more generally. Using the Rutgers Health and Human Development Project sample drawn in New Jersey, Labouvie et al. (1997) showed that illicit drug use and heavier alcohol use are, regardless of age of onset, adolescence-limited phenomena for most individuals. Again, although based on only a few cohorts in one state, the findings seem likely to hold more generally.

Thus, these and other regionally based longitudinal studies have made and will continue to make major and complementary contributions to our understanding of developmental changes in drug use during adolescence and young adulthood. There remain, however, certain distinct advantages to having at least some longitudinal studies based on large nationally representative samples. One advantage is the possibility to examine variation on several potentially relevant factors, such as region of the country, urbanicity, social class, ethnic background, and so on. If such variables have main effects (which most of them do in relation to drug use) or interaction effects, these would be missed in analyses of a sample in which they do not vary. As suggested by our broad-based conceptual framework discussed in Part 1, this emphasis on "social address" variables is a critical feature in the attempt to gain a more contextually sensitive (and more

realistic, we believe) understanding of the developmental course of drug use (e.g., Biglan, 1995; Brook, Gordon, Brook, & Brook, 1989; Pandina et al., 1984; Schulenberg & Maggs, in press; Szapocznik & Coatsworth, 1999).

Another advantage of a longitudinal study of a broad population base is the possibility to draw a comparable sample from a comparable population at a later time point, permitting comparison of the longitudinal patterns and relationships observed in the earlier cohort with those in the later one. Without the ability to replicate the population from which a representative sample is drawn, it is not possible to determine whether observed changes are due to differences in the populations studied at the two points in time, to real changes in maturational trends and relationships, or to both. For example, because Youth in Transition was based on a representative national sample of a male cohort, we are able to compare longitudinal findings from it with those from males in the Monitoring the Future project. Had either of these studies been a purposive or convenience sample, however, such comparisons would be far more difficult—perhaps impossible—to interpret reliably. Of course, this capability also has been a critical feature of our nationally representative college samples over the years, and will continue to be so as the demographics of the college population continue to change.

Still another advantage of large, national, cohort-sequential longitudinal samples is that they permit panel analyses of some subgroups which comprise fairly small fractions of the population (e.g., daily marijuana users)—both because of the large samples, and because we can concatenate across a number of cohorts to increase sample size. Of course, this would be easiest when there are no secular trends taking place in the drug under study; however, it is also possible for analyses to include adjustments for such secular trends. By focusing on important subgroups of drug users in our national sample, say frequent binge drinkers or daily marijuana users, we are in a position to offer important data regarding the overall and subgroup specific epidemiology and etiology of drug use. That is, we can (a) determine the proportional size of the given subgroup and (b) determine whether the causes and consequences of drug use in that group vary vis-à-vis the population at large (cf. Schulenberg et al., 1996a, 1996b, 2001a). In fact, we have oversampled active drug users in high school for inclusion in the follow-up samples from the beginning, including current daily marijuana users.

Similarly, in addition to the other benefits of having several cohorts represented (as discussed previously under Objectives 4 and 5), having panel data on several cohorts readily permits cross-validation (again, in the absence of secular trends), increasing the generalizability of the identified developmental patterns and trends. This cross-validation capacity proved important in our recent emphasis on social role and environmental effects on drug use during the transition to young adulthood (Bachman et al., 1997a, 1997b, 2002). In particular, as discussed further below, we were able to offer strong conclusions regarding the impacts of engagement, marriage, and divorce on changes in drug use. Sometimes, however, not all developmental patterns cross-validate, and to the extent that these reflect systematic cohort effects, then we are able to offer data on changes in developmental patterns as a result of social change. For example, in examining developmental patterns of drug use and well-being during the first few years out of high school, we found shifts over the past decade to suggest that the transition to young adulthood has become more difficult (Schulenberg et al., 2000).

The Monitoring the Future project is broad not only in terms of population and cohorts, but also in terms of drug-related substantive domains, a breadth that corresponds to our multi-faceted conceptual framework discussed in Part 1. While we tend to refer to drug use measures as the dependent variables in our analyses, as discussed under Objective 1, many other factors are proposed for examination in Monitoring the Future, including attitudes about use, beliefs about the harmfulness of drugs, exposure, availability, peer attitudes, reasons for use, social contexts of use, and the social connotations of use. Whether or not one uses different drugs, and the intensity of one's use, depend to some extent on how supportive one's psychosocial context is towards drug use (e.g., the number and types of parties one attends, perceived norms of friends). What has not received much attention until recently (e.g., Bachman et al., 2002), however, is how the elements of the psychosocial context of drug use may change during adolescence and into young adulthood and beyond (cf. Kandel et al., 1990; Newcomb & Bentler, 1988). Because of the size of the instrument package, we can examine longitudinally the developmental changes in numerous relevant contextual and psychological variables, and relate such change to changes in drug use.

The importance of having this array of variables present over time can be illustrated in relation to the classic issue of cessation of drug use. O'Donnell et al. (1976, p. 69) advanced lack of peer support as at least a partial explanation for why some men discontinue their use of illicit drugs, an explanation consistent with other findings (e.g., Johnson & Kaplan, 1990; Oetting & Beauvais, 1987). The notion is that some men were willing to experiment with drugs as long as some of their friends were using, but, as fewer of their friends were using, there was less support for their own use. Ultimately they discontinued use, suggesting that a change in exposure to friends' use of drugs leads to a change in drug use. (Of course, the reciprocal causation, or a combination of both, is equally tenable.) Nevertheless, changes in a number of other variables could also lead to changes in drug use; for example, changes in attitudes and beliefs, or changes in availability of drugs. It is thus valuable to be able to study longitudinally all these factors as well as drug use itself, and the breadth of content contained in these instruments allows for this kind of study. Changes in these factors associated with entering different types of environments and role statuses can be examined as possible explanations for associated changes in actual use. Indeed, after our intensive analysis effort to examine changes in drug use as related to social role changes during young adulthood (Bachman et al., 1997a, 1997b), we then examined more closely the explanatory processes by focusing on changes in a wide variety of person and contextual characteristics during the transition to young adulthood (Bachman et al., 2002).

Approaches to understanding individual-level change and stability in drug use. Three points about our approach to understanding change and stability at the individual level over time are noted here. *First*, the difficulties and complexities of panel analyses are more than offset, we believe, by the richness and importance of detail gained. To illustrate, both cross-sectional and longitudinal data would likely provide similar evidence that the prevalence of drug use increases during adolescence and peaks during the transition to young adulthood. Nevertheless, the cross-sectional data would not permit a consideration of the stability of individual differences. For example, without longitudinal assessment, we do not know whether an individual who uses more cocaine than his or her peers during adolescence continues to use comparatively more cocaine during and after the transition. Indeed, with only cross-sectional prevalence rates, it is not possible to determine whether the peak that occurs during young adulthood represents (a) a

generalized, relative increase and subsequent decrease in drug use for many individuals, with individual differences remaining very stable during and after the transition (e.g., those who used drugs more than their peers continued to do so); (b) a blending of several change patterns, with individual differences being unstable during and after the transition; or (c) a combination of the two patterns, with individual differences being unstable during but stable after the transition. Each of these patterns has quite different implications regarding the epidemiology and prevention of drug use. Only with longitudinal data can they be examined. Indeed, in the case of binge drinking, we have found that pattern "b" just described best represents the panel data during young adulthood (Schulenberg et al., 1996a, 2001a); and based on current analyses (manuscript in preparation), the same holds true for marijuana use and other illicit drug use.

Second, because stability and change over time can be viewed in a variety of ways, several approaches to analyses are needed to understand the natural history of drug use. As alluded to above, a consideration of both mean-level change over time, as well as the stability of individual differences over time, provides important and distinct information. The advantages of a multivariate approach over time are numerous. In particular, a multivariate approach permits consideration of structural relations over time, and especially the use of structural equation modeling (SEM) techniques (LISREL, EQS). These techniques were used to consider causal relationships between substance use and educational commitment and success (Bachman, Schulenberg, O'Malley, & Johnston, 1990; Bryant et al., 2000; Schulenberg et al., 1994) and part-time work (Safron et al., in press; see also Olmstead, Guy, O'Malley, & Bentler, 1991; O'Malley & Bachman, 1983; O'Malley, Bachman, & Johnston, 1983; Osgood, Johnston, O'Malley, & Bachman, 1988; Osgood, Wilson, O'Malley, Bachman, & Johnston, 1996), and they continue to be useful in current analyses of the data.

Of course, SEM techniques are ideally suited for developing and testing models of causal patterns (or at least temporal precedence) with longitudinal quasi-experimental data. Nevertheless, it is important not to overlook their power in simply *describing* what occurs to relationships among variables over time. Particularly with the inclusion of the eighth and tenth graders, structural equation modeling techniques may be useful in describing the underlying structural (or qualitative) changes among constellations of variables (e.g., perceptions of drug-related norms) that may occur over time. For example, drawing from Werner's (1957) orthogenetic principle (i.e., "whenever development occurs, it proceeds from a state of relative lack of differentiation to a state of increasing differentiation, articulation, and hierarchic integration" [p. 126]), it may be the case that there is little differentiation among perceptions of different drugs at eighth grade, and that these perceptions become more differentiated (and hierarchically integrated) over time. Similarly, as we have noted elsewhere, components of deviance appear to become differentiated during the transition to young adulthood (Osgood et al., 1988; see also Newcomb & Bentler, 1988; Newcomb & McGee, 1991). Confirmatory factor analysis techniques are ideally suited to test this possible developmental progression (cf. Baltes & Nesselroade, 1973; Schulenberg, Shimitzu, Vondracek, & Hostetler, 1988).

Although we have traditionally taken a "variable-centered" approach to understanding change over time, there are some advantages of complementing this with a "pattern-centered" or "person-centered" approach (e.g., Magnusson, 1988; Magnusson & Bergman, 1988; von Eye, 1990), as has become common in the relevant drug use literature (e.g., Chassin et al., 1991, in press; Colder et al., 2001; Labouvie et al., 1991). One way to do this, as discussed further under

Objective 6b, involves developing typologies of developmental trajectories (or dynamic typologies, as described by Huizinga, 1995), which provides a rather unique way to examine change simultaneously in the dependent and independent variables, something that can be fairly cumbersome with traditional variable-centered approaches. We have considered this pattern approach in analyses concerning, for example, binge drinking during the transition to young adulthood (Schulenberg et al., 1996a, 1996b, 2001a) and drug use sequencing (Johnston & Schulenberg, in preparation). In our ongoing efforts, this approach will be useful in efficiently tracking, for example, the developmental trajectories of frequent and heavy illicit drug users and poly-drug users over time.

Another way to examine differential change patterns, as well as to examine change simultaneously in dependent and independent variables, is represented by the latent growth curve modeling (LCM) approach (e.g., McArdle, 1988; Meredith & Tisak, 1990; Muthén, 1991; for recent illustrations see, e.g., Curran, 2000; Curran, Harford, & Muthén, 1995; Duncan & Duncan, 1994, 1995, 1996; Muthén & Muthén, 2000; Stoolmiller, Duncan, Bank, & Patterson, 1993). Briefly, in this approach, the shapes of change over multiple waves (e.g., linear, quadratic, cubic) are conceptualized as latent variables, and individual differences in these shapes can be predicted with other time-varying and static constructs; likewise the latent growth curves (say in marijuana use over 8 waves) can be used to predict consequences, with the implication being that it is not so much initial level of marijuana use that contributes to negative consequences, but rather the pattern of marijuana use over time (see Objectives 3 and 7). The recent applied extension of LCM, known as growth curve mixture modeling (e.g., Muthén, 2001; Muthén & Muthén, 2001), permits the consideration of different categories of change patterns over time (allowing for within-category random effects) and is thus useful for determining the different types of change patterns (an empirical counterpoint to the more conceptual pattern-centered approach described in the preceding paragraph). We have recently started to conduct growth mixture modeling analyses to determine patterns of change in marijuana use during young adulthood, and we look forward to continuing to utilize this technique. We recognize, of course, that LCM is just one of the approaches under the broader category of random effects models (Laird & Ware, 1982; Raudenbush, 2001) that take into account intra-individual change over time. Another related approach is Hierarchical Linear Modeling (HLM) (e.g., Raudenbush & Chan, 1993; Raudenbush et al., 2000; Bryk & Raudenbush, 1992), and we look forward to continuing to apply appropriate random effects models to the MTF panel data.

The *third* and final point is quite relevant to the use of pattern-centered approaches, as well as LCM and HLM. Although it certainly increases the complexity of the analyses, employing more than two waves of panel data is necessary for addressing many questions (but certainly not all or even most questions) concerning change and stability over time in general (e.g., Rogosa, 1979) and concerning the natural history of drug use during adolescence and early and middle adulthood in particular. In addition, having more than two waves of data may facilitate the examination of the processes that underscore causal relationships over time (e.g., as illustrated in Newcomb & McGee, 1991). Furthermore, three or more waves are particularly useful when attempting to delineate age-specific patterns vis-à-vis secular trend and cohort effects (e.g., see O'Malley et al., 1988), and to examine the causes and effects of age of drug use initiation and cessation (cf. Rutter, 1988).

Risk and protective factors. Before discussing the sub-objectives concerning change in drug use during the secondary school and post-high school years, it is useful to consider briefly our emphasis on the specification of multiple risk and protective factors in understanding the etiology of drug use during adolescence and young adulthood, a perspective that follows from our conceptual framework summarized earlier in Part 1. Recent extensions of this work combine an understanding of the natural history of drug use, a wealth of available contextual as well as drug use variables, and new approaches to longitudinal data analyses. In a series of chapters and articles, we have put forth a developmental-contextual conceptual framework that emphasizes the key features and advantages of a developmental perspective on substance use etiology and prevention during adolescence and young adulthood. Using MTF (and other) data, we illustrated the importance of examining substance use in relation to developmental tasks and transitions, as well as of examining individual trajectories of substance use and related factors over time (Schulenberg, Bryant, O'Malley, Bachman, & Johnston, in preparation; Schulenberg & Maggs, 2001, in press; Schulenberg, Maggs, Long et al., 2001; Schulenberg, Maggs, Steinman, & Zucker, 2001; Schulenberg, O'Malley, Bachman, & Johnston, 2000). Some common themes across these papers include an emphasis on multidirectional change (e.g., diverging and converging trajectories of substance use over time); concern with more interactive and time-varying relations among risk factors and substance use; an understanding of how major developmental transitions (and major changes in social roles and contexts) relate to changes in health risks; and an emphasis on alternative analytic strategies that permit description and explanation of individual trajectories of substance use and related factors using multi-wave panel data. This evolving framework, which has drawn heavily on earlier MTF analyses, has been useful in many of the recent and new MTF empirical papers.

The focus on risk and protective factors, a focus drawn largely from the epidemiology and developmental psychopathology literatures (e.g., Anthony & Cohler, 1987; Catalano et al., 1996; Cicchetti, 1999; Kellam & Rebok, 1992; Garmezy, 1985, 1988; Glantz, 1992; Glantz & Hartel, 1999; Glantz & Leshner, 2000; Rolf, Masten, Cicchetti, Nuechterlein, & Weintraub, 1990; Rutter, 1979, 1988, 1990) has become of increasing interest to those conducting research on adolescent drug use (e.g., Blackson & Tarter, 1994; Brook et al., 1990; Brook, Whiteman, Finch, & Cohen, 1995; Bry, McKeon, & Pandina, 1982; Clayton, 1992; Clayton, Leukefeld, Donoew, & Bardo, 1995; Curran & Chassin, 1996; Dielman, Schulenberg, & Weinberg, 1993; Glantz & Leshner, 2000; Glantz & Pickens, 1992; Hansen & O'Malley, 1996; Hawkins et al., 1992a; Kumpfer & Turner, 1990; Newcomb, 1992, 1997; Newcomb et al., 1986b; Oetting, 1992; Rhodes & Jason, 1990; Schulenberg et al., 1994, 1996a; Sher, Walitzer, Wood, & Brent, 1991; Weinberg, Rahdert, Colliver, & Glantz, 1998; Zucker, 1989, 1994). Risk and protective factors refer to those elements in the individual, in the context, and in the interaction between the individual and the context, that alter the likelihood of drug use (e.g., Brook et al., 1990; Glantz, 1992; Dielman et al., 1993). Given specific constellations of risk and protective factors, it would be possible to characterize individuals as vulnerable to (i.e., at risk for) or resilient to drug use.

In particular, the focus on risk as well as protective factors is important. Although many protective factors (e.g., good school performance) may appear to be simply the opposite of risk factors (e.g., poor school performance), suggesting a redundancy in terminology and conceptualization, such is not necessarily the case (e.g., Clayton, 1992; Hawkins et al., 1992a; Rutter, 1990; Schulenberg et al., 2001b). To illustrate, although few would argue that avoiding long-distance running is a risk factor for cigarette use, long-distance running may well be viewed

as a protective factor against cigarette smoking. Risk and protective factors can also be viewed as operating differently within an interactive framework (e.g., Brook et al., 1990, 1995c; Brook, Nomura, & Cohen, 1989; Rutter, 1990; Szapocznik & Coastworth, 1999). For example, some protective factors against illicit drug use (e.g., self-efficacy) may operate regardless of whether certain risk factors are present, whereas others (e.g., teacher or coach serving as a strong role model) may operate only (or may be more powerful) in the presence of specific risk factors (e.g., father absence). Indeed, as we found in regard to risk factors for increased binge drinking during the transition to young adulthood, some risk factors (e.g., low self-efficacy) appear unconditional, whereas others (e.g., low conventionality) depend on one's initial level of drinking (Schulenberg et al., 1996b). In addition, as Brook et al. (1990a) effectively demonstrate, viewing risk and protective factors over time permits consideration of how early risk factors can be ameliorated by later protective factors.

Also, consistent with our conceptual framework discussed in Part 1, a risk and protective factor perspective engenders a broader, more complex, more realistic, and ultimately more useful perspective on the etiology of drug use (Clayton, 1992; Schulenberg & Maggs, in press; Schulenberg et al., 2001b). For example, by focusing on a multitude of risk and protective factors, it becomes much easier to acknowledge that the causes of drug use are multiple and not necessarily always additive or overlapping (e.g., Brook et al., 1990; Bry et al., 1982; Hawkins et al., 1992a; Newcomb, 1992; Weinberg et al., 1998). Indeed, having only a few risk factors for drug use may not make an individual vulnerable to drug use (Clayton, 1992; Newcomb et al., 1986b); likewise, a complete lack of risk factors may not make an individual resilient against drug use—it would leave one untested and thus may actually make one vulnerable if and when later risk factors appear (Rutter, 1990; Schulenberg et al., 2001b). By focusing on protective factors, more emphasis is placed on understanding why some individuals do *not* use drugs (see, e.g., Baumrind & Moselle, 1985; Dielman et al., 1993; Perry & Jessor, 1983), an emphasis that certainly is important in guiding prevention and asset-building efforts (Lerner, 2001).

Finally, in terms of examining risk and protective factors from a developmental perspective, we have found it useful to focus on the health risks and opportunities engendered by the several developmental transitions that occur from adolescence through adulthood (Schulenberg & Maggs, in press; Schulenberg et al., 2001b). That is, in addition to a focus on individual, contextual, and interactional risk and protective factors, it is also important to view developmental or "ecological" transitions (cf. Bronfenbrenner, 1979) as increasing or decreasing one's vulnerability to drug use (Szapocznik & Coastworth, 1999). In particular, various developmental transitions (e.g., school transitions, romantic involvement transitions, cognitive and self-image transitions) can be viewed as composites of risk and/or protective factors (e.g., Graber & Brooks-Gunn, 1996; Schulenberg & Maggs, in press; Schulenberg, Maggs, & Hurrelmann, 1997b). For example, the transition to junior high school could contribute to increased drug use for a variety of reasons, including (a) the transition increases stress levels and overwhelms coping capacities, (b) the transition decreases the match between individual needs and contextual affordances, (c) the transition increases exposure to a wider and older range of peers, and/or (d) the transition is accompanied by changing norms regarding the appropriateness of drug use; in contrast, other transitions (e.g., into marriage) work in a protective fashion by, for example, increasing the match between individual desires and contextual affordances and/or decreasing norms about excessive drug use (Schulenberg et al., 1997b). This focus on developmental transitions as increasing and decreasing one's vulnerability to drug use

corresponds closely with our findings regarding social role transitions during the transition to young adulthood (e.g., Bachman et al., 1997a, 1997b, 2002).

Objective 6a: To assess during the *secondary school* years the impact of individual characteristics (e.g., values, beliefs, lifestyles, and other behaviors such as delinquency, school performance, and religiosity) and social environments (e.g., part-time work, sports and other extra-curricular activities, activities outside of school, peer groups) on drug use and related factors, with particular emphasis on the specification of risk and protective factors.

The Monitoring the Future project has had a synergistic emphasis on understanding both the epidemiology and etiology of drug use during adolescence and young adulthood. Efforts to understand the etiology of drug use are greatly enhanced by cross-sectional and longitudinal data from the eighth and tenth grade students. (As we discussed previously, national eighth and tenth grade surveys began in 1991, and random subsamples of the 1991-93 eighth graders are followed into young adulthood.) In particular, these national cross-sectional and panel data sets based on adolescents will help to provide answers to questions concerning (a) causal influences during adolescence, (b) distinctions between causes and correlates of drug use initiation versus drug use maintenance, (c) distinctions between causes of experimentation with drug use versus more long-term involvement with drug use, (d) variations in the causes, correlates, and consequences of drug use as a function of age of initiation, and (e) sequencing of drug use. In short, we will be able to understand adolescent drug use within the broader context of adolescent development, a perspective that we and others believe is essential (e.g., Baumrind & Moselle, 1985; Brook et al., 1990; Chassin, 1984; Clayton et al., 1995; Hawkins et al., 1992a; Kandel, 1985; Labouvie et al., 1991; Newcomb & Bentler, 1988; Pandina & Johnson, 1999; Petraitis et al., 1995; Schulenberg & Maggs, in press; Schulenberg et al., 2001b; Szapocznik & Coatsworth, 1999; Windle & Davies, 1999).

The understanding of the antecedents and etiology of drug use during adolescence has commanded much conceptual and empirical attention, especially over the past decade or so. The enormous literature base on this subject is certainly too large for any attempt at a comprehensive review here. Less than 25 years ago, Kandel (1978b) was able to encompass as chapters in a single volume the then limited number of longitudinal studies. Since that time, the number of relevant longitudinal studies has expanded dramatically (many of which were discussed and cited above and throughout this paper). The various studies have established or confirmed the importance for the prediction of drug use during adolescence of a considerable array of demographic and family background characteristics, attitudes, other personality characteristics, earlier problem behaviors and academic difficulties, peer behaviors, and various other characteristics of the social environment. In deciding upon the substantive foci of the eighth and tenth grade surveys, we have drawn extensively from the many important advances that have occurred in this relevant literature (as well as from our findings regarding salient predictors of drug use based on seniors and young adults); at the same time, with the unique strengths of the Monitoring the Future national cross-sectional and longitudinal components, we are hopeful that our findings can considerably advance this literature.

In the discussion of Objective 1, we looked at several individual and social environmental characteristics (and the relevant literature concerning each) that will continue to serve a dual role

in consideration of both the epidemiology and etiology of drug use. Because of the desirability of surveying the eighth and tenth graders with a shorter instrument, not every social indicator is included in these adolescent samples. Of those considered in Objective 1, the following are included in our analyses to determine their part in the etiology of, and abstention from, drug use during adolescence: (a) perceived risk of different levels of use of various drugs, (b) personal disapproval of different levels of use of various drugs, (c) perceptions (social connotations) concerning cigarette smokers, (d) exposure to peer drug use (including felt peer pressure to use), (e) availability of various drugs, (f) social and physical contexts of drug use, and (g) reasons for not using marijuana. In addition, the sequencing of drug use, both prior to the eighth grade (using retrospective data concerning grade at first use), and during high school (using the prospective longitudinal data) also is considered. There are several other individual and social environmental characteristics that are included in the adolescent data, and thus can be included in our analyses to specify the risk and protective factors of drug use. Next, we consider briefly a few of these characteristics.

Educational commitment and success. One of the more powerful domains of influence on adolescent drug use is educational commitment and success. Because of this, we included a wide range of relevant items in the eighth and tenth grade base year and follow-up surveys, such as grades, school track, college plans, hours spent on homework, school enjoyment, truancy, expulsion and suspension, grade retention, trips to the principal's office, difficulties in completing assignments, and dropping out of school. With the 1991-93 eighth grade panels, we are in a position to examine how educational success and failure, including dropping out, relate to drug use.

Decades of research indicate that students who are successful in school and committed to continuing their education are less likely to be involved in deviant or health-compromising behaviors. In particular, the evidence is clear that these students are less likely to be users of cigarettes, alcohol, or illicit drugs during high school (e.g., Bachman, O'Malley, & Johnston, 1978; Barnes & Welte, 1986; Brook et al., 1989; Bryant et al., 2000, submitted; Chassin, 1984; Clayton, 1992; Duncan et al., 1998; Donovan & Jessor, 1985; Eggert & Herting, 1993; Galambos & Silbereisen, 1987; Hawkins et al., 1992a; Hundleby, 1985; Johnston, 1973; Kandel, 1980; Kaplan, 1985; Kasen, Cohen, & Brook, 1998; Newcomb & Bentler, 1986b; Schulenberg et al., 1994). The interconnections between substance use and educational indicators such as grade point average (GPA), perceived school success, college plans, and truancy are complex and have been subject to a variety of causal interpretations.

The evidence indicates that school difficulties precede substance use, at least temporally, if not also causally (e.g., Brunswick & Messeri, 1984; Bryant et al., 2000, submitted; Engel, Nordlohne, Hurrelmann, & Holler, 1987; Gerber & Newman, 1989; Johnston, 1973; Kandel, 1980; Kaplan, 1985; Safron et al., in press). In particular, we (Bryant et al., 2000) developed and tested competing conceptual models concerning the causal relations among school misbehavior, academic achievement, and cigarette use during middle adolescence. Using the MTF eighth grade panel data, we found through a series of structural equation models that the predominant direction of influence was from school experiences to substance use: school misbehavior and low academic achievement contributed directly and indirectly to increased cigarette use over time. These findings, which were robust across gender and ethnicity, suggest

the importance of early substance use prevention efforts focused on reducing school misbehavior and academic failure.

Among several of the explanations offered for this phenomenon of substance use being influenced by school- and academic-related factors, one common conceptualization is that substance use emerges as a response, either directly or indirectly via association with substance-using peers, to the frustrations of poor school performance (e.g., Chassin, Mann, & Sher, 1988; The Consortium on the School-Based Promotion of Social Competence, 1994; Johnston, 1973; Kandel, 1980; Kaplan, 1985; Labouvie, 1986; Silbereisen & Noack, 1988). Another common conceptualization is that both poor school performance and subsequent substance use reflect a more general pattern of behavior that may signal difficulties in psychosocial functioning and adjustment (Hurrelmann, 1990), including unconventionality (Donovan & Jessor, 1985; Huba & Bentler, 1982), lack of institutional bonding (e.g., Elliott et al., 1989; Hawkins, Lishner, Jenson, & Catalano, 1987; Hirschi, 1969), or dissatisfaction with perceived future opportunities (e.g., Brunswick & Messeri, 1984; Engel et al., 1987). Consistent with these two general conceptualizations is the notion that school success serves to protect the adolescent against substance use, perhaps through increasing self-esteem or reinforcing school bonding (e.g., Hawkins et al., 1987, 1992a; Hundleby, 1985). A third common conceptualization, which makes reference to "precocious development," is that noncollege-bound adolescents may be anticipating an earlier entrance into adulthood roles, and using drugs and alcohol may be viewed as facilitating this process (e.g., Bachman & Schulenberg, 1993; Newcomb & Bentler, 1988; Silbereisen & Noack, 1988).

There is some evidence, of course, indicating that substance use may also contribute to school difficulties (e.g., Brook et al., 1989; Galambos & Silbereisen, 1987), as well as to dropping out of high school (e.g., Friedman, Bransfield, & Kreisher, 1994; Krohn, Thornberry, Collins-Hall, & Lizotte, 1995; Mensch & Kandel, 1988a; Newcomb & Bentler, 1986b), and suggesting that substance use may contribute to decrements in motivation or academic functioning (cf. Baumrind & Moselle, 1985). Some of our recent research, described more fully below, suggests that substance use and educational commitment/success influence each other in a negative reciprocal fashion over time during adolescence, each serving to reinforce the other (Safron et al., in press). It remains, however, a matter of future research to provide further evidence for this reciprocal process. Monitoring the Future's panel data collection from those who were eighth graders in 1991, 1992, and 1993 has at least four advantages for addressing the gaps in the relevant literature: (a) tracking students before they drop out, facilitating the consideration of causal relationships; (b) providing four or more waves of data, making it possible to consider causal links over time; (c) over-sampling eighth graders who were likely to become dropouts, ensuring a sufficiently large sample; and (d) because of the over-sampling of poor school performers, providing a panel comparison group of those who did not drop out, but nonetheless had poor grades and other hallmarks of inadequate school bonding, permitting more accurate estimation of the causes and consequences of dropping out versus doing poorly in school. Having the three sequential cohorts has allowed for concatenation of the data to ensure sufficiently large samples.

Finally, in terms of school-related risk and protective factors, it is important to consider possible interactive effects, particularly in terms of how school risk and protective factors interrelate. Bryant, Schulenberg, Bachman, O'Malley, and Johnston (submitted) considered how

early school experiences influenced the course of substance use from ages 14 through 20. Based on growth curve analysis using hierarchical linear modeling (HLM) with four waves from the MTF eighth grade panel data, we found that school misbehavior and peer encouragement of misbehavior at age 14 were positively associated with initial substance use and increased substance use over time; school bonding, school interest, school effort, academic achievement, and parental help with school were negatively associated. Of particular importance, positive school attitudes were protective factors for those adolescents with low academic achievement. Currently, Rogala, Schulenberg, and Bachman (in preparation) are examining the risk and protective factors for subsequent substance use within groups of eighth graders with high GPA and those with low GPA.

Parents and peers. Parents represent a powerful source of influence on adolescent drug use. In considering the many ways in which parents influence adolescent drug use (e.g., Baumrind, 1985; Brook et al., 1999a; Brook et al., 1989; Brook, Whiteman, Balka, & Cohen, 1995; Dishion & McMahon, 1998; Duncan, Duncan, & Hops, 1996; Hawkins, et al., 1986b, 1992b; Kandel, 1980; Murray & Perry, 1985; Oetting, & Donnermeyer, 1998; Simons, Conger, & Whitbeck, 1988; White, et al., 1986; Wu & Kandel, 1995), the most important protective factors appear to be parental monitoring and nurturance (e.g., Ary et al., 1999; Barnes, Farrell, & Banerjee, 1994; Biglan, Duncan, Ary, & Smolkowski, 1995; Blackson & Tarter, 1994; Brook, Brook, Gordon, & Whiteman, 1990; Johnson & Pandina, 1991; Kumpfer & Turner, 1990; Schulenberg, 1996; Steinberg, 1987), as well as parent-adolescent communication and concordance regarding norms and values (e.g., Baumrind, 1987; Dielman, 1994; Kandel, 1980; Peterson, Hawkins, Abbott, & Catalano, 1994; Turner, Irwin, & Millstein, 1991).

While positive parenting practices are viewed as strong protective factors against substance use during adolescence, key questions remain about the moderators and mediators of parenting effects on substance use. Using MTF cross-sectional eighth and tenth grade data, Pilgrim, Schulenberg, O'Malley, Bachman and Johnston (submitted) examined the mediating effect of school and peer factors on the parental involvement-substance use link, and the moderating effect of gender and ethnicity on these relations. Structural equation modeling analyses revealed that school success and peer involvement were partial mediators of parental involvement and risk taking on drug use. Multi-group analyses showed much similarity across gender and ethnic subgroups in these relations. In another analysis we found, using MTF cross-sectional and panel data, that conventionality is an important mediator of parenting practices on substance use, and that this was generally consistent across gender and ethnic subgroups (Wynn, 1999; other manuscript in preparation).

Peers also represent very powerful sources of influence on adolescent drug use (for reviews, see e.g., Clayton, 1992; Clayton et al., 1995; Hawkins et al., 1992a; Kandel, 1985; Oetting, 1992; Weinberg et al., 1998), sometimes competing against the protective force of parents (e.g., Duncan, Duncan, & Hops, 1994; Brook et al., 1990; Silbereisen, Petersen, Albrecht, & Kracke, 1989), and other times working in conjunction with parental influences to increase or decrease the adolescent's vulnerability to drug use (e.g., Biglan et al., 1995; Brown, Dolcini, & Leventhal, 1997; Dishion et al., 1995). In fact, early and middle adolescence is when parents and peers begin to "trade places" in terms of their influence on individuals (e.g., Bailey & Hubbard, 1990; Steinberg & Silverberg, 1986).

With respect to the influence of peers, one theoretical position is that unstructured socializing with peers in the absence of authority figures engenders opportunities for deviant behavior. The presence of peers makes deviant acts, including drug use, easier and more rewarding; the absence of authority figures reduces the potential for social control; and the lack of structure leaves time available for deviant behavior. This "routine activities" perspective guided analyses of five waves of data from the MTF sample (Osgood et al., 1996). Results showed that participation in routine activities (e.g., riding in a car for fun, spending evenings out for fun, visiting with friends, going to parties) was strongly associated with delinquent behavior, heavy drinking, marijuana use, and use of other illicit drugs (see also Safron et al., in press). Further, participation in routine activities accounted for a substantial portion of the association of these deviant behaviors with age, gender, and socioeconomic status.

Several items in our eighth, tenth, and twelfth grade surveys permit us (a) to address a variety of topics relevant to parental influences, peer influences, and the interaction of parental and peer influences on adolescent drug use; and (b) importantly, to determine whether parental and peer influences vary as a function of historical time (i.e., secular trends or cohort effects).

Rebellious and delinquent behavior. Other robust covariates of drug use during adolescence include rebellious and delinquent behavior. There is a large amount of literature on the relationship between drug use and delinquent, antisocial, and criminal behavior (for reviews and conceptual overviews, see e.g., Clayton, 1981; Clayton & Tuchfeld, 1982; Elliott, 1993; Hawkins et al., 1992a; Jessor, 1998; Kaplan, 1995; Kellam, Rebok, Wison, & Mayer, 1994; Loeber, 1990; Patterson, DeBaryshe, & Ramsey, 1989; Weinberg et al., 1998; Zucker, 1994). Several longitudinal investigations (to name just a few: Brook, Whiteman, & Finch, 1992; Brook et al., 1995b; Dishion et al., 1995; Donovan & Jessor, 1985; Donovan, Jessor, & Costa, 1988; Elliott et al., 1985, 1989; Huba & Bentler, 1982; Johnson & Pandina, 1991; Johnston, 1973; Johnston, O'Malley, and Eveland, 1978; Kandel, Simcha-Fagan, & Davies, 1986; Kaplan et al., 1986; White et al., 1986; Windle, 1990) have confirmed the association between drug use and delinquent or criminal behavior. Analysis of the MTF young adulthood longitudinal panels demonstrated that this relationship is best conceived as reflecting an underlying propensity toward deviance, as a number of others have argued, rather than as reflecting some causal paths either from drug use to delinquent behavior, or vice versa (Osgood et al., 1988). In some of our earlier work reporting on two different national cohorts of males (Johnston & O'Malley, 1978; Johnston, O'Malley, & Eveland, 1978), we found that an index of illicit drug use (as well as each illicit drug taken individually) was positively correlated with self-report indexes of Theft and Vandalism and of Interpersonal Aggression, the latter index showing a considerably stronger relationship. Based on our analyses of the time sequences involved, we concluded that the delinquency was not caused by the drug use, but rather that the drug use was likely an age-related expression of a tendency toward deviance. Jessor and Jessor (1977, 1978) have made a similar point in their longitudinal work with high school and college students, but others have questioned whether there might in fact be some causal connection (e.g., Clayton, 1981), and still others question this common etiology explanation (e.g., Elliott, 1993; White, 1991). Analyses of the MTF adolescent panel data will continue to shed some light on these issues of causal relationships, building upon the relevant and long-term panel studies of adolescents and young adults listed earlier, on whom both drug use and delinquency measures exist.

Selected personality characteristics. Decades of research have documented the importance of personality influences on drug use during adolescence and young adulthood. Consistent with the relevant literature, we consider personality characteristics in broad terms, and include personality and behavioral attributes (e.g., Brook, Whiteman, Gordon & Cohen, 1986; Block et al., 1988). Several personality domains consistently have been found to relate to alcohol and other drug use: (a) antisociality/alienation (e.g., Block et al., 1988; Brook, Cohen, Whiteman, & Gordon, 1992; Jessor & Jessor, 1977); (b) low conventionality (e.g., Chassin et al., 1991; Jessor et al., 1991; Newcomb & Bentler, 1988); (c) low personal control orientation (e.g., Jessor et al., 1991; Newcomb & Harlow, 1986; Sadava & Thompson, 1986); and (d) risk taking and sensation seeking (e.g., Bates & Labouvie, 1995; Baumrind, 1987; Chassin, 1984; Donohew, Lorch, & Palmgreen, 1991; Martin & Robbins, 1995; Newcomb & McGee, 1991; Wills, Vaccaro, & McNamara, 1994; Windle, 1994). Evidence regarding the link between self-esteem and substance use is equivocal (e.g., Kaplan, 1985; Labouvie & McGee, 1986; Newcomb et al., 1986a), and limited evidence suggests an inverse relationship between identity (e.g., relating to purpose in life) and substance use (e.g., Newcomb & Harlow, 1986). One individual-level characteristic that has not received much attention, but still may hold promise in terms of understanding the etiology of drug use during adolescence, is future orientation. As part of the normative developmental processes and tasks (e.g., increased capacity for hypothetical thinking, contextual presses), thoughts and plans about the future become more salient during middle and late adolescence (e.g., Nurmi, 1991; Lewin, 1939), and a lack of future orientation (for whatever reasons, ranging from lack of perceived opportunities to lack of interest) may have some impact on, and in turn be influenced by, drug use during adolescence (e.g., Brunswick & Messeri, 1984; Engel, Nordlohne, Hurrelmann, & Holler, 1987). Our adolescent panels include data on each of these potentially important individual characteristics, and although some may not prove robust in main effects models, consistent with our above discussion on risk and protective factors, they may prove robust in some interactive models.

Part-time work. A final domain of potential influence on adolescent drug use that we will discuss here is part-time work. Part-time work during adolescence had long been viewed as a panacea, curing everything from the limitations of formal schooling to the difficulties in the transition to young adulthood (e.g., National Commission on Youth, 1980). Over the past decade or so, there have been several important challenges to this positive view of part-time work, most notably a series of studies (some of which were longitudinal) conducted by Greenberger and Steinberg and their colleagues (e.g., Greenberger & Steinberg, 1986; Steinberg & Dornbusch, 1991; Steinberg, Fegley, & Dornbusch, 1993; Steinberg, Greenberger, Garduque, Ruggiero, & Vaux, 1982), in which work intensity (i.e., number of hours worked per week) was found to contribute to an increase in drug use. Other researchers, most notably Mortimer and colleagues (e.g., Finch, Mortimer, & Ryu, 1997; Mortimer, Finch, Shanahan, & Ryu, 1990) have questioned the causal direction between long hours and drug use. In general, although our findings from the senior year samples have shown a positive relationship between work intensity and drug use (Bachman, Johnston, & O'Malley, 1981b; Bachman, Bare, & Frankie, 1986), our findings suggest that the part-time work intensity may be more a concomitant rather than a cause of drug use (Bachman & Schulenberg, 1993, 1999; Schulenberg & Bachman, 1993; see also Mortimer & Johnson, 1998; Entwisle, Alexander, & Olson, 2000). Using data from several cohorts of the MTF eighth, tenth, and twelfth graders, Safron, Schulenberg, and Bachman (in press) found evidence supporting two mechanisms by which work intensity and substance use are related: (a) time trade-off (long hours at work interfere with time for more developmentally

beneficial experiences, contributing to substance use as coping); and (b) precocious development (substance use and long hours of work are part of a constellation of behaviors in younger adolescents that are more normative for older adolescents). In an analysis of three waves from the MTF eighth grade panel data (N = 2,687), Safron, Rogala, Schulenberg and Bachman (submitted) examined several alterative models concerning within- and across-time relations among work intensity, preferred work intensity, school detachment, dating, and substance use. Based on a series of structural equation modeling analyses, findings generally supported a selection hypothesis. Additional analyses nearly completed, covering eighth and tenth grade students, as well as those in twelfth grade, include a "wishing to work" measure introduced in some MTF questionnaire forms beginning in 1992. The analyses show that simply wishing to work long hours is correlated (positively) with substance use; moreover, among younger students (many of whom do not work while in school) the desires for long hours of work are more strongly linked with substance use than are actual hours of work. The findings suggest that much of the link between long hours of part-time work and substance use may reflect prior causes, such as educational failure and disengagement. In other words, although working long hours while a student may contribute to problems, the desire and (later) decision to work such long hours can also be a symptom of preexisting problems.

Recent special topic analyses on risk and protective factors. A strength of the MTF design is that we can not only examine the relationship between risk and protective factors at a given time, but also consider the extent to which those relationships change over time. Building on earlier MTF analysis (Bachman et al., 1980), as well as other studies (e.g., Donovan et al., 1999), Brown et al. (2001a) examined whether risk and protective factors for substance use are consistent across historical time, based on analyses of MTF data from high school seniors from the classes of 1976 through 1997. The analyses showed a relatively high degree of consistency across time, as well as some consistency across four substances (cigarettes, alcohol, marijuana, and cocaine). Consistent negative correlates of substance use (i.e., protective factors) were religiosity and high grades; consistent positive correlates (i.e., risk factors) were truancy and frequent evenings out for fun and recreation. There was some noteworthy inconsistency, however, especially concerning college plans, parent education, region, and urbanicity, underscoring the need for continued consideration of how the relationships between risk factors and drug use are shifting historically. Many of these subgroup trends are now displayed graphically for all three grades in a Web-based Occasional Paper (Johnston et al., 2001a).

In a recent analysis (An, et al., 1999), we focused on changes in daily smoking rates among high school seniors across two decades (1976-1995), and found that shifts were more likely to occur among seniors classified as "high risk" (based on such risk factors as GPA, truancy, evenings out, and religious commitment). This general "elasticity" in daily cigarette rates runs contrary to general wisdom and suggests that preventive efforts should not exclude the high-risk segment.

This overview of relevant issues, literature, and data concerning the etiology of drug use during adolescence is necessarily brief and selective. There are, of course, a number of other individual and social environmental characteristics included in the adolescent panel data that will be considered in terms of their influence on the etiology of adolescent drug use. These include several background characteristics (including region, urbanicity, school size, race/ethnicity, parental education level, number of parents living in the home), peer climate in the school,

extra-curricular activities at school, involvement in organized activities outside of school, religiosity, frequency and type of social activities, driving and riding in cars (including when alcohol is involved), health-promoting activities, and a variety of attitudes concerning human nature, sex roles, and future parenthood.

Objective 6b: To assess during the *post-high school* years the impact of individual characteristics, changes in major social environments (college, military service, civilian employment, homemaking, unemployment), as well as changes in roles (marriage, pregnancy, parenthood, divorce) on drug use and related variables.

There has been much emphasis in the literature lately on the importance of the transition period between adolescence and adulthood, on the one hand (e.g., Arnett, 2000), and on the importance of understanding substance use etiology within a broader lifespan framework of risk and resilience, on the other (e.g., Cichetti, 1999; Glantz & Hartel, 1999; Windle & Davies, 1999). We have continued to merge these two streams by considering how substance use may relate (as a cause, correlate, and consequence) to difficulties in negotiating the transition to adulthood.

A major and ongoing effort of the project has been to examine social role changes during the transition to young adulthood and how these changes relate to changes in drug use. In particular, we undertook this task in our 1997 book (Bachman et al., 1997a; see also Bachman et al., 1997b). Because the book is quite comprehensive, both in terms of its review of the relevant literature and in terms of the coverage of role transitions, we offer only a brief overview here. The roles and experiences of young adulthood are closely interrelated and often reflect longstanding differences in backgrounds, abilities, and aspirations. Such complexities were taken into account using multivariate analyses (detailed in an extensive appendix to the book), and we focused particularly on two distinct types of linkage between drug use and young adult experiences—differential *changes* and *stable* differences. For example, low rates of heavy drinking and illicit drug use among married respondents were linked directly to the transition to marriage, rather than reflecting long-standing differences. Similarly, we showed that women sharply decreased their alcohol and illicit drug use during pregnancy—and even their smoking to some degree. A very different sort of pattern was the low smoking rates of college students, which were shown to be a clear extension of pre-existing differences—the link between smoking and educational success is firmly in place by the end of high school. In sum, the analyses in this book were able to demonstrate that much of the age-related rise in use of cigarettes, alcohol, marijuana, and cocaine during the years following high school can be traced to the new freedoms experienced by young people moving out of their parents' homes; and the analyses also showed that the subsequent declines in drug use are attributable to the new conditions involved in marriage and parenthood.

In our recent sequel book (Bachman et al., 2002) we examined behaviors and attitudes that may mediate the associations between post-high school experiences and substance use. As with our earlier book, only key results from our new book are summarized here. Some differences between college students and their age-mates can be attributed to college students' increased likelihood to go to parties and to spend time informally with friends, and to go to bars, taverns, and nightclubs. Going to college is associated also with modest shifts in views about heavy drinking and about marijuana use. Whereas during high school the college-bound are

more likely than average to perceive risks and to disapprove, a year or two later (after they became full-time college students) their risk and disapproval ratings are just about average. The effects of marriage on attitudes and behaviors may help to explain the associations between marriage and reduced substance use. The importance of religion increases somewhat among those who marry, and married respondents show larger increases in perceived risks and disapproval than respondents in any of the other living arrangements categories. Marriage is also associated with the largest declines in frequencies of (a) evenings out for fun and recreation, (b) attendance at parties and other social affairs, (c) getting together with friends informally, and (d) going to bars, taverns and nightclubs. Indeed, one reason that many young adults engage in these activities is to find a partner—a motivation that presumably subsides considerably after marriage. Married respondents also are less likely than average to have friends who get drunk or use illicit drugs. Pregnant women and also men with pregnant spouses show increases in perceived risk and disapproval ratings. This suggests that increased concerns about health consequences underlie the reductions in substance use that occur among pregnant women and men with pregnant spouses.

As one part of these efforts, we have focused specifically on the impact of military service on drug use behavior. Several early large-scale surveys indicated that illicit drug use was clearly higher among those in military service (Bray, Marsden, & Peterson, 1991; Segal, 1977). Data from the Youth in Transition panel (Johnston, 1973) were consistent with that conclusion; and Robins (1974) reported very high levels of marijuana and heroin use among young men returning from Vietnam. In seemingly direct contradiction to those findings, O'Donnell et al. (1976) found virtually no difference between those who served in the military and those who did not in mean scores on an index of illicit drug use. However, O'Donnell's sample covered a ten-year age span corresponding roughly to the high school classes of 1962 through 1972. Closer inspection revealed that marijuana and heroin use figures for those who were in Vietnam during the last years of the war correspond rather well with those from the Robins study. In other words, there appears to have been a cohort difference even in the relative standing of those in military service versus those in civilian life, and the findings from one period are simply not generalizable to the other. Indeed, in an analysis of the senior year cohort of 1976, Johnson and Kaplan (1991) found little difference in terms of the rates of initiation of marijuana use and of escalation to daily marijuana use as a function of military status.

Analyses reported by Bachman et al. (1997a) indicated that military service was strongly associated with increased use of *licit* drugs, cigarettes and alcohol, and decreased use of *illicit* drugs. These effects were relatively independent of other effects associated with transitional changes (i.e., getting married, becoming a parent).

We continued to examine military service in our latest book (Bachman et al., 2002) and found some explanation for the changes in alcohol use associated with military service. Those in military service at follow-up showed greater than average increases in evenings out in general, and in going to bars in particular. They also showed greater than average declines in their disapproval of having five or more drinks in a row once or twice each weekend, and they were more likely than average to report having friends who got drunk at least once a week. A more fine-grained analysis of links between military enlistment and drug use (Bachman, Freedman-Doan, O'Malley, Johnston, & Segal, 1999b) employed senior-year and first follow-up panel data to contrast male military enlistees with young men who entered college and those who were in

full-time civilian employment (too few women enlisted to permit these analyses). Five time intervals were compared (senior classes of 1976-79, 1980-83, 1984-87, 1988-91, 1992-95), and important differences were found for different substances across time. Illicit drug use dropped sharply after the military introduced mandatory drug testing in 1980, although in senior year (i.e., prior to enlistment) those headed for military service were about average in their use of illicit drugs (marijuana and cocaine). This suggests that illicit use among high school seniors who later entered military service was not at a level of dependence that prevented their quitting use after enlistment. The findings for half-pack or more daily cigarette use were distinctly different. Prior to the institution of smoke-free basic training in 1989, military enlistees (like those who entered civilian employment, and contrast to those who entered college) were above average in proportions of half-pack or more smokers; however, after 1989 the military was able to recruit fewer such regular smokers—presumably because some individuals who otherwise would have preferred to enlist were too heavily dependent on cigarettes to manage an extended period of non-smoking.

In another effort focusing specifically on the "launching period" following high school, Schulenberg et al. (2000) grouped respondents into nine different life-paths based on their achievement and affiliative experiences immediately following high school (e.g., moved away from home, attended college full-time, remained single) and examined the course of substance use and well-being during the transition to young adulthood. Following high school, well-being tended to increase for all, with the exception of those who became single parents and those who remained at home and were neither a full-time worker nor student. In contrast, we found that drug use tended to increase most for those who left the parental home and remained single. Results were found to vary somewhat by cohort in a pattern suggesting that the transition to young adulthood has become somewhat more difficult for more recent cohorts. Building on these findings, Schulenberg and Bryant (2001) examined the timing, sequencing, and covariation of various transitions in a panel sample of 4,071 MTF seniors followed to age 26 and found, for example, that a greater number of transitions was associated with higher well-being and lower substance use during the transition to adulthood. Findings concerning different configurations of transitions suggest that delaying the transitions into adulthood roles is associated with continued substance use. In an examination of how success in negotiating the developmental tasks of young adulthood (concerning education, work, romantic involvement, peer relations, citizenship and financial independence) relate to well-being and substance use in a panel sample of 2,910 MTF seniors followed to age 26, Schulenberg, Bryant, O'Malley, Bachman, and Johnston (in preparation) found that success in developmental tasks was associated with salutary trajectories of well-being and lower overall substance use.

There has been a continued focus on college students using the MTF young adult follow-ups. One manuscript (O'Malley & Johnston, in press) focused on MTF data on college student alcohol and drug use, including a comparison of MTF data with other sources of national samples of college students. There are two major advantages of the MTF design: one is that students are not clustered by institution, providing a much more efficient sample, and the second is that pre-college data are available, making conclusions about effects of college attendance much firmer. In building on previous MTF analyses that identified different trajectories of binge drinking (Schulenberg, Wadsworth, O'Malley, Bachman, & Johnston, 1996), evidence was found to link more troublesome trajectories of binge drinking and other drug use with fraternity and sorority membership, greater risk taking, and less conventionality among college students; at

age 30, those whose binge drinking subsided after college were indistinguishable in terms of psychosocial functioning from those who were not binge drinkers in college, whereas the group that continued to drink heavy after college appeared to be functioning less well in all domains of life (Schulenberg, 2000; Schulenberg, Maggs, Long et al., 2001). McCabe, Schulenberg, Johnston, O'Malley, and Bachman (in preparation) are examining how substance use during college, especially among members of fraternities and sororities, is a function of selection and socialization influences.

Adolescent risk and protective factors for young adult drug use. In another series of analyses using the young adult panel data, we focused on adolescent risk and protective factors for changes in drug use during the transition. In a structural equation modeling effort with panel data, we examined the impact of high school educational success on subsequent changes in drug use (Schulenberg, Bachman, O'Malley, & Johnston, 1994). While we found that high school GPA remained a protective factor against substance use during the transition, college plans in senior year related to increased alcohol use during the transition. In contrast to a purely selection or socialization hypothesis, the findings support a differential socialization hypothesis in which (a) selection factors set the stage for differential entry into young adult roles and experiences, and (b) these roles and experiences then serve to shape changes in drug use over time.

There has been some focus in the literature on adolescent personality risk factors for later drug use, and we find this an especially important focus given our emphasis on risk and protective factors and developmental transitions. In regard to the possible long-term robustness of risk factors in these personality domains, the evidence is strongest for low conventionality (e.g., Donovan et al., 1983; Jessor et al., 1991; Newcomb & Bentler, 1988; Stacy, Newcomb & Bentler, 1991). Consistent with the notion that it is a central characteristic of deviance proneness (Jessor & Jessor, 1977), low conventionality in adolescence appears to make one vulnerable to increased drug use during the transition to young adulthood. Although there is little direct evidence regarding the domain of antisociality/alienation, the extensive literature on childhood aggressive and antisocial antecedents of adolescent substance use and deviancy (e.g., Block et al., 1988; Caspi, Lynam, Moffitt, & Silva, 1993; Kellam, Simon, & Ensminger, 1983; Loeber, 1982) suggests that those high in this domain during adolescence are vulnerable to increased binge drinking during the transition; however, other evidence suggests that this personality domain may not have long-term predictive power across the transition (Zucker, 1994). Although the direct evidence for personal control orientation is limited and mixed (e.g., Chassin et al., 1991; Jessor et al., 1991), the successful negotiation of the transition is partly dependent on adolescent planfulness and self-efficacy (e.g., Clausen, 1991; Nurmi, 1993; Werner & Smith, 1992), suggesting that to the extent that increased drug use reflects difficulties with the transition, low personal control orientation may be a robust predictor. Finally, although the limited evidence regarding the robustness of self-esteem and identity is equivocal (e.g., Jessor et al., 1991; Kaplan, 1985; Newcomb et al., 1986a), those low in this domain toward the end of adolescence may well be more prone to difficulties with the transition (Erikson, 1968), including increased drug use. Analyses in progress are using this methodology for understanding risk factors for changes in marijuana use during the transition, and our use of the eighth grade national panels followed into young adulthood will provide an important vantage point from which to better understand the link between developmental transitions and vulnerability to drug use.

Correlates of substance use and midlife. Our oldest cohorts have now entered middle adulthood (ages 35 and 40), and this has provided us the opportunity to consider the long-term consequences of earlier substance use (discussed when considering Objective 7) as well as the correlates and causes of midlife substance use. Merline, Schulenberg, and O'Malley (2001) examined contemporaneous effects of substance use at age 35 on parenting practices and attitudes toward teenage use. Heavy drinking at age 35 was associated with less positive parenting. Parents who use any given substance are less likely than other parents to disapprove of their children using the same substance. Of particular interest, disapproval of teenage substance use was higher among parents whose oldest child is 10 to 17 than among parents whose oldest child is 9 or younger. Merline, O'Malley, Schulenberg, Johnston, and Bachman (submitted) examined the prevalence of age 35 substance use, and considered the impact of demographic characteristics, adulthood experiences, and age 18 substance use. In general, the findings indicate that at the beginning of midlife, when adulthood family and societal responsibilities are central, substance use is still rather prevalent (e.g., 1 out of 10 custodial fathers was a current marijuana user), and is a function of adulthood roles and experiences, as well as of previous use.

While the analytic possibilities may seem overwhelming, it is useful at least to mention the range that exists. Obviously, we must of necessity be highly selective in the choice of variables used in each class of analysis, and we can mine only a limited proportion of the rich veins of findings that still await discovery in the database. That is one reason we have elected to archive the data and to provide a variety of other means of access so that they will be readily available for analysis by others. (The subject of sharing the data will be discussed more fully under Objective 11.) The MTF data sets provide unique and valuable opportunities to understand the course, causes, and correlates of drug use from early adolescence through middle adulthood. We turn next to a consideration of the consequences of drug use.

Objective 7: To assess both the short- and longer-term consequences of various types of drug use—particularly heavy use—on a number of outcomes in the domains of physical health, psychological well-being, status attainment, role performance, driving performance, deviant behavior, and social alienation.

The potential negative consequences of drug use for youth run the gamut from health impairment, temporary or permanent impairment of cognitive functioning, development of emotional instability, violent or other delinquent behavior, psychomotor impairment while driving or in other potentially hazardous situations, delay of psychosocial maturation, reduction in motivation or performance in school or on the job, acquisition of a criminal record, involvement with criminals, serious impairment of interpersonal relationships, and possibly even death due to overdose, allergic reaction, or (with injection use) AIDS. Before considering some relevant research (ours and that of others), we focus briefly on some of the problems inherent in the study of consequences, and on MTF design features that can help overcome such problems.

There has been a great deal of research on the effects of various types of illicit drug use on peoples' lives (Bentler, 1992; Brook, Balka, & Whiteman, 1999; Brook & Newcomb, 1995; Brook, Richter, & Rubenstone, 2000; Brook, Richter, Whiteman, & Cohen, 1999; Brunswick, 1984; Friedman, Bransfield, & Kreisher, 1994; Friedman, Granick, Bransfield, Kreisher, &

Schwartz, 1996; Glantz, 1984; Guy, Smith, & Bentler, 1994; Institute of Medicine, 1982; Jessor, Donovan, & Costa, 1991; Johnson & Kaplan, 1990; Kandel, Davies, Karus, & Yamaguchi, 1986; Kandel & Yamaguchi, 1987; Kandel, 1978a; Newcomb & Bentler, 1988; Pandina, Labouvie, Johnson, & White, 1990; Stein, Smith, Guy, & Bentler, 1993; Stein, Newcomb, & Bentler, 1987; White & Bates, 1993). Nevertheless, much remains to be learned, and some of the answers are likely to be important in future prevention efforts.

Of the illicit drugs, marijuana received the most research attention during the 1970s and early 1980s, in part because this study documented how large a proportion of America's young people were becoming heavy users of the drug. Many of the results of that work have been summarized and reported to the Congress in the form of Marijuana and Health reports to Congress, and NIDA has published a series of monographs on marijuana research specifically (Braude & Ludford, 1984; Glantz, 1984; Petersen, 1980; Rapaka & Makriyannis, 1989). An earlier comprehensive review was conducted by the Institute of Medicine (1982), which drew heavily on results from Monitoring the Future. Of course, there is considerable research on the effects of other drugs as well; cocaine in particular has been the subject of intensive efforts since the early 1980s (Cregler, 1989; Czechowicz, 1988; Grabowski, 1984; Kozel & Adams, 1985; Schober & Schade, 1991; Tims & Leukefeld, 1994). The specter of "crack babies" generated a spate of research on the effect of cocaine use by pregnant women in particular .

While much of the extant research has been concerned with cannabis and cocaine, many of the problems encountered are common to research on just about all drugs used outside a supervised medical regimen. First, there are many different patterns of use to be found for almost any psychoactive drug. A number of people use it only once or twice, others sporadically, some chronically in small quantities, some chronically in large quantities, and so on. For any given drug the potential consequences will surely vary across these different patterns of use. Second, the time lag between the damaging behavior and appearance of any evidence of damage can vary from minutes to decades. The longer the lag, the more difficult is the problem of discovering the link. To quote Petersen (1977, p. 1), "There is considerable evidence from experience with other drugs that many years of use by a substantial number is required for the implications of widespread drug use to surface." Third, negative effects are usually not certain, but occur on a probabilistic basis; this is true for the connection between lung cancer and smoking, for example. Thus the research necessary to discover connections may need to encompass a large number of heavy users, who may be difficult to find given the relatively low number of such users in the population and the difficulty of getting them to identify themselves and to participate in the research.

Fourth, the negative consequences may occur only with particular kinds of people—pregnant women, those going through puberty, or the emotionally unstable, to take three disparate examples. Fifth, the effects may be quite indirect and, therefore, difficult to recognize and to trace accurately to a source. For instance, involvement with drugs is likely to affect friendship patterns, which in turn may affect the development of life goals and aspirations. Or, a young person who is intoxicated much of the time may not participate in many other activities which ordinarily would have filled the same time—activities which might have advanced that young person's social skills, maturity, or knowledge in some area. Sixth, young people who become involved with drugs tend to differ from the average on many important personal and environmental characteristics. It may be that negative outcomes superficially attributed to drug

use are really due to these pre-existing differences. Finally, the use of each psychoactive drug tends to be positively correlated with the use of all other psychoactive drugs, which makes disentangling their effects—particularly their long-term effects—all the more difficult.[10] For all these reasons, research on the effects of using the various illicit drugs has been and remains particularly difficult.

The Monitoring the Future design is well-suited for dealing with the assessment of a number of possible effects, particularly in light of some of the problems just mentioned. First, it is based on natural population samples, which permits the assessment of a wide range of different usage patterns, and which gives it a higher probability of identifying user groups for whom use of the drug (say marijuana) is not highly confounded with the use of others. Additionally, the fact that the sample is nationally representative means most potentially confounding variables will vary enough that their effects can be estimated and statistically controlled. Given the great breadth of measurement in the study, there is at least a reasonable chance that important conditioning or control variables are included among the measured variables.

The samples are also relatively large, permitting the identification of more heavy users and more users of some of the drugs that are less prevalent than marijuana (cocaine, for example)—a necessity for meaningful research, particularly given the probabilistic basis on which many effects are likely to occur. The fact that longitudinal panels are included in the design is critical, for obvious reasons. Further, the developmental period encompassed by the longitudinal panels beginning in twelfth grade is a particularly good one, partly because many of the respondents will be at the starting or early stages of use, and also because they will be making a number of major life decisions in this interval (e.g., to enter or to leave college, military service, employment, marriage, parenthood, and so on). Such decisions themselves may reflect psychosocial effects of drug involvement. The developmental period encompassed by the longitudinal panels beginning in eighth grade is even better of course, because it starts earlier, at a point prior to initiation of illicit drug use in most cases. Some of these respondents will be making a critical decision—whether to drop out or stay in school, a decision that may be particularly influenced by drug involvement.

The range of variables for which potential drug-use effects can be examined in this study is quite large. Psychosocial variables comprise the great majority of variables for which we can examine potential effects. We can examine the effects of a wide array of value and lifestyle orientations, including attitudes, values, and beliefs about education, work, family, leisure, religion, politics, social action, social change, and various social issues (see Objective 6). Assessments of social and political alienation and views about a number of specific social institutions are also included.

In the domain of affective states and other general personality characteristics, the potential exists to look at outcomes such as self-esteem, depression, internal and external locus of control, loneliness, risk-taking propensity, pessimism, satisfaction in a number of life

[10]A more complete discussion of these types of methodological issues in research on marijuana effects, specifically, may be found in Bentler (1977) and Smith et al. (1977).

domains, and overall happiness and life satisfaction. In some cases, these personality characteristics may also serve as control variables.

A particularly important set of outcomes deals with attainment of certain social statuses and roles and performance in major life roles. In the educational sphere, available measures include college entrance, successful completion of college, academic performance, and satisfaction with school and college. In the work sphere, proportion of time gainfully employed, status of attained occupation, hourly pay rate, annual income, stability of employment, days missed from work, financial independence, and job satisfaction are measured. Concerning family roles, the study contains measures of marital status (including divorce or separation), number of children, and satisfaction with marriage. Respondents also are asked in a separate set of questions how well prepared they feel they are to function effectively in the roles of spouse, parent, and worker and how well they feel they actually will function in those roles.

In the important domain of delinquency and rebelliousness, we include repeated measures of the frequency with which respondents commit a number of delinquent and criminal acts. While our own work (Johnston et al., 1978; Osgood et al., 1988) and that of others would not lead us to expect increased deviance as a result of illicit, non-addictive drug use, the possibility remains that those findings may be subject to change, as the drug scene changes.

While the study initially contained few direct measures of physiological outcomes, it did contain some measures that may be indirect indicators. For example, our measures include an index of somatic symptoms, which we have found to relate to an index of illicit drug use. There is also a measure of days missed from school (or work, in the post-high school questionnaires) due to illness. Respondents also are asked directly whether their illicit drug use has caused them any physical health problems. In 1982, we added a number of more direct measures of physical health or illness, having to do with symptoms of physical and mental illnesses, physician visits, and hospitalizations for injuries and other types of problems.

The connection between drug use and nearly all of the outcomes discussed earlier would have to be inferred statistically. It is also possible, of course, to ask the respondents to play a more active role by self-reporting any outcomes they perceive to result from their drug use. While this approach certainly has pitfalls, it has some advantages which complement the statistical inference approach. Therefore, a list of problems which might result from drug use are included in the measurement package. Respondents are asked to give their own assessment of whether each problem has resulted from their use of alcohol, marijuana, or other illicit drugs. Among the problems included are harmful effects on relationships with parents, spouse, friends, teachers, and supervisors; involvement with people who are a bad influence; lowered performance in school and/or job; lowered emotional stability; lowered interest in other activities; lowered energy level; lowered ability to think clearly; "other bad psychological effects"; unsafe driving; poor health; behavior which was later regretted; and, involvement with the police. An earlier analysis, looking only at daily marijuana users, suggests that they report a number of these adverse outcomes (Johnston, 1980).

In the questionnaires sent to respondent at modal ages of 35 and 40, we ask a similar set of questions about their use of alcohol, marijuana, and other illicit drugs in the past five years.

We also included some questions designed to assess abuse or dependence symptoms. These questions will likely be included in the proposed age 45 questionnaires, as well.

The addition of eighth grade panels has increased substantially our ability to look at consequences of adolescent involvement in drug use, particularly early involvement, which is likely to have more harmful effects than later onset substance use—an issue that we will be pursuing over the proposed grant period.

Some of the possible long-term consequences have been investigated empirically via other longitudinal studies (Bray, Zarkin, Ringwalt, & Qi, 2000; Brunswick, 1984; Ellickson et al., 1998; Guy, Smith, & Bentler, 1994; Jessor, Donovan, & Costa, 1991; Johnson & Kaplan, 1990; Kandel, Davies, Karus, & Yamaguchi, 1986; Kandel & Yamaguchi, 1987; Kandel, 1978; Newcomb & Bentler, 1988; Pandina, Labouvie, Johnson, & White, 1990; Stein, Smith, Guy, & Bentler, 1993; Stein, Newcomb, & Bentler, 1987; White & Bates, 1993); however, as noted by Johnson and Kaplan (1990, p. 278), the evidence concerning long-term consequences is mixed; now, a decade after their commentary, there is still much to be learned about the consequences. Moreover, as Newcomb and Bentler (1988) noted, there has been rather limited theory development regarding the effect of adolescent drug use on later life outcomes. They discuss some theories or hypotheses related to consequences of adolescent drug use; these theories are not mutually exclusive, and they have generally not been tested empirically. These include impaired functioning, developmental lag, consolidation of regressive coping, amotivational syndrome, psychosocial dysfunction, use leads to abuse, problem behavior theory, self-derogation, role compatibility theory, and precocious development. Some of these theories and hypotheses, such as those concerning self-derogation (Johnson & Kaplan, 1990) and precocious development (Newcomb & Bentler, 1988), have had more empirical testing than others.

Our own first efforts at investigating long-term possible consequences of a range of drug use during high school were reported by O'Malley (1991). Those analyses, using multiple linear regression, made clear that high school drug use is significantly associated with outcomes nine to ten years past high school graduation. In particular, it appears that educational attainment is deleteriously affected by high school drug use. Illicit drug use (marijuana, cocaine, and an index of other illicit drug use) varied in the extent to which significant direct effects survived controls for high school lifestyle factors. In essence, it appears that the effect of drug use in reducing educational attainment has primarily manifested itself by the end of senior year of high school. Thus, students who become involved with illicit drugs in high school become (or already are) poor students, likely to be truants, and as a result, are less likely to further their education. Some deleterious effects of illicit drug use on occupational outcomes and marital behaviors also seem to be present, whereas rather few independent effects are seen for health outcomes and deviant behaviors, after controlling other factors. Alcohol and cigarette use also show the deleterious effects on educational attainment (though the effects are weakened substantially when lifestyle variables are controlled).

Additional analyses have incorporated later, post-high school drug use, to assess whether the effects of high school drug use are completely mediated through later drug use. These analyses have used structural equation modeling (Bentler, 1990) to take into account errors of measurement, and to permit the use of latent variables with multiple observed indicators. In general, the results are highly similar to the earlier linear regressions: most of the action of high

school drug use is mediated through the lifestyle variables as measured near the end of high school.

In a recent publication, we examined the relationship of marijuana use by high school seniors to occupational attainment ten years later (Schuster et al., 2001). Analyses were conducted separately by gender, with and without controlling for other variables; we used the models for dependence of cross-classifications having ordered categories presented by Goodman (1983). Control variables, all measured when respondents were seniors, were academic performance, educational aspirations, and occupational aspirations. Results indicate that the influence of marijuana use on occupational attainment was considerably different for males and females. For males the bivariate relationship between marijuana use and occupational attainment was depicted by a threshold model in which no or light marijuana use does not predict level of occupational attainment. Once a threshold level is passed (say three occasions of marijuana use in the last year), increasing marijuana use predicts linearly to decreasing success with respect to occupational attainment. This relationship between marijuana use and occupational attainment did not persist when control variables were entered, suggesting that marijuana use exerts its influence on occupational attainment by reducing school performance and lowering educational as well as occupational aspirations. For females the bivariate relationship between marijuana use and occupational attainment was more complex, suggesting a range of possible negative and neutral relations.

Our oldest cohorts have now entered middle adulthood (ages 35 and 40), and this has provided us the opportunity to consider the long-term consequences of earlier substance use. Our more recent efforts at examining consequences of drug use have utilized latent growth methodology (Duncan et al., 1999; Muthén & Curran, 1997). Here we have utilized all nine measurement occasions (twelfth grade, seven biennial follow-ups through age 32, and age 35) to consider the effect of trajectory of substance use on age 35 outcomes (manuscript in preparation). Earlier attempts at latent growth methodology estimated three latent growth factors: intercept, linear slope, and a quadratic term (O'Malley & Schulenberg, 1997). Difficulties in interpreting the meaning of quadratic terms (in the presence of a linear slope) led us to shift to a "piece-wise" approach wherein the substance use is modeled as having two linear slopes (Li et al., 2001): an initial positive slope (representing increased substance use after high school graduation) and a later negative slope (representing decreased substance use among most respondents as they mature). The outcome measures at age 35 include measures of happiness, satisfaction with life roles, substance use problems and dependence indicators, and occupational status. Results show clear deleterious effects from the trajectory of substance use in the expected direction. For example, relatively high later slope (either increasing or decreasing less than average) of marijuana use predicts lower occupational success, and more problems and dependence symptoms associated especially with marijuana, but also with other illicit drugs and with alcohol. In a similar set of analyses, Schulenberg (2001; also Schulenberg, O'Malley, Merline, Johnston, & Bachman, in preparation) examined the impact of the level and course of substance use during adolescence and young adulthood (ages 18-32) on parenting practices and attitudes about teenage substance use at age 35. Using latent growth modeling analyses with eight waves of panel data (N = 4,500), it was found that both intercepts and linear slopes of marijuana use and heavy drinking were significant and powerful predictors of age 35 disapproval of teenage substance use, and less powerful but still significant predictors of age 35 positive

parenting. These findings suggest both direct and indirect mechanisms concerning the intergenerational transmission of susceptibility to substance use.

We expect to build upon and extend these recent analyses in the proposed grant period. Our ongoing efforts to understand consequences of drug use are facilitated by two features of the study design. One is that we have extended the age range to 40, and that is proposed to be further extended to age 45. This extension of the panel sample will increase the time span for which to consider long-term consequences. Second, we have three panels of eighth graders (1991-93 cohorts) that are being followed through young adulthood, and these panels will enable us to begin our efforts to understand consequences earlier in the drug progression sequence.

Objective 8: To give special emphasis throughout to the more frequent or heavier users of the different drugs, i.e., individuals most likely to be characterized as "abusers." (This objective crosscuts most of those above.)

The distinction between use and abuse has long been a cloudy one (e.g., Smart, 1974) and quite controversial, but most definitions of abuse are based on the notion of use that is detrimental to the users or to society. For example, in considering a comprehensive definition of substance abuse, Newcomb and Bentler (1989) state:

> Adverse or negative consequences of use on self, others, or property, such as having deleterious health sequelae, impaired relationships, getting arrested, causing an accident, blacking out, or starting fights, indicate that use has progressed to abuse. . . (p. 243).

Accordingly, although some may argue from a moralistic or legal position that *any* use of an illicit drug by an adolescent or young adult constitutes abuse, an alternative position that defines abuse in terms of consequences would take account of the quantity and/or frequency of use. In any case, there is undoubtedly a consensus that heavy use, however defined, is worse for the user than light or occasional use.

In the MTF study, there is an ongoing and cross-cutting emphasis on the frequent and heavy use of licit and illicit drugs. This emphasis is evident throughout all of the previously discussed objectives (as well as in Objectives 9 and 10), and includes, for example, the monitoring of secular and developmental trends in frequent and heavy use, as well as the causes, correlates, and consequences of frequent and heavy use. In addition, a set of questions is included in the twelfth grade surveys regarding the respondent's cumulative experience with daily marijuana use, the age of starting such use, and so on. (Results from these questions are routinely reported, as are a number of the other heavy or frequent use measures, in the study's annual monographs, e.g., Johnston, et al., 2001a). Furthermore, in the young adult follow-up surveys, there is some emphasis on measures of drug abuse as defined by negative consequences (e.g., whether one's use is causing social and occupational difficulties). This emphasis is expanded in the age 35 and 40 surveys (and proposed age 45 survey), in which we included some emphasis on drug dependence (e.g., tolerance). Thus, in addition to our ongoing consideration of frequent and heavy drug use, we will include some consideration of drug abuse and dependence in future efforts.

With the ongoing young adult surveys, the middle adulthood surveys, and the eighth grade follow-up surveys (for 1991-93 eighth grade cohorts), we are able to track the course and consequences of frequent and heavy use from early adolescence through middle adulthood. In the extensive discussions of Objectives 1 and 6, it was suggested that by tracking individuals over time the chronicity, abstinence, incidence, and remission of frequent and heavy drug use during adolescence and adulthood may be determined. By focusing on individuals over several points in time, various developmental trajectories (e.g., increasing, decreasing, quadratic trends) of frequent and heavy use can be identified, and then the antecedents, concomitants, and consequences of the various trajectory groups can be determined. This strategy, characterized as a person- or pattern-centered approach in developmental literature (e.g., Block, 1971; Cairns & Cairns, 1994; Cairns, Cairns, Rodkin, & Xie, 1988; Magnusson & Bergman, 1988), has been used with increasing frequency in the substance use literature to examine change and stability in frequent and heavy use of licit and illicit drugs (e.g., Chassin et al., 1991, in press; Colder et al., 2001; Curran, 2000; Donovan et al., 1983; Labouvie et al., 1991). As discussed previously under Objective 6, we used this strategy to identify the different trajectories of frequent binge drinking from adolescence through young adulthood (Schulenberg et al., 1996a, 1996b, 2001a). An added feature of using this strategy with nationally representative data is that we are able to address the prevalence rates of the different trajectories (e.g., 1 percent were chronic frequent binge drinkers from adolescence through young adulthood). In addition to assisting in understanding the course of frequent and heavy use over time, this pattern-centered focus can also be particularly important in specifying risk and protective factors. In particular, risk factors for chronic heavy drug users are not the same for those following other developmental trajectories of drug use (e.g., Bates & Labouvie, 1995; Duncan, Duncan, & Hops, 1996; Labouvie et al., 1991; Schulenberg et al., 1996b, 2001a).

Obviously, greater attention to frequent and heavier users is also important for understanding short-term and long-term consequences of drug use. As previously discussed under Objective 7, documenting consequences can be quite difficult, but it seems clear that heavier users are most at risk and that focusing on them is an improvement on past over-emphasis of how many ever used a drug. Not that the latter is unimportant, but rather distinctions among experimenters, occasional users, and frequent users in much of the epidemiological reporting have not been made. The large samples in Monitoring the Future provide sufficient numbers of heavy users of most drugs to provide meaningful panel data on heavy users in the normal population, although we recognize that the most extreme cases—such as heroin or crack addicts—are unlikely to be covered, either because they never finished high school or because they failed to participate in the follow-up surveys. As mentioned above, there is an ongoing emphasis on measures of drug *abuse* in the young- and middle-adulthood surveys, and some new emphasis on drug *dependence* in the middle-adulthood surveys. Thus, not only can measures of drug abuse and dependence be considered as consequences of earlier and ongoing frequent and heavy use, but they can also be considered as causes of psychosocial difficulties (manuscript in preparation; Schulenberg, 2001; Schulenberg et al., in preparation).

We turn now to a brief discussion of individual drugs. In addition to the definitional problems of drug abuse as discussed above, there are problems associated with quantifying heavy illicit drug use. For example, in research on licit drugs such as alcohol use, frequency and amount of use are most often combined to provide a measure of abuse (e.g., Cahalan & Room, 1974; see also Hilton & Clark, 1987). Another indication of alcohol abuse is heavy drinking,

which is often defined as having five or more drinks in a row (e.g., Blane, 1979; Knupfer, 1989; Kusserow, 1991; Wechsler & Isaac, 1992). Unfortunately, illegal drugs as popularly consumed are not as amenable to an accurate quantitative measurement. There is no standard proof for marijuana or heroin as there is for alcohol, for example, nor traditional quantities (such as a shot or a 12-ounce can) for most illicit drugs as they are commonly used.

As one way of attempting to address this difficulty, questions about the duration and degree of intoxication on an average occasion of use have been included in the senior year and young adult surveys (as discussed earlier), although it is quite likely that a certain amount of noise is introduced by individual differences in subjective judgments or, for that matter, in actual reactions to a given dose of a drug. These measures provide some valuable gross distinctions among individuals, for example, between someone who usually gets high for an hour versus someone who usually gets high for five or ten hours, and also some important comparisons across drugs. For examples of the former, see Johnston (1980), and of the latter, Johnston et al. (1991, 1996).

Some interesting hypotheses have been generated by the trend results for these variables (i.e., the degree and duration of highs) among high school seniors. For marijuana, there was a general downward trend between 1978 and 1983 in the degree of highs usually obtained, followed by an increase among more recent cohorts. In 1978, 73 percent of the users said they usually got "moderately high" or "very high"—a figure that dropped to 64 percent by 1983, increased to 71 percent in 1990, 70 percent in 1995, and stands at 71 percent in 2000. Similarly, there was a downward and then upward trend in the proportion of users saying they stayed high three or more hours (from 52 percent of the users in 1975 to 35 percent in 1983; this proportion increased to 39 percent in 1990, 45 percent in 1995, and back down to 39 percent in 2000). These earlier downward trends were inconsistent with the evidence showing a dramatic increase in the THC content in marijuana over that decade, suggesting, as we argued elsewhere (Johnston, 1980; Johnston et al., 1991), that not only were fewer high school students using marijuana, but those who were using seemed to be using less frequently and to be taking smaller amounts (and doses of the active ingredient) per occasion. That is, users titrated their intake to obtain particular levels of THC to achieve a certain (perhaps declining) level of high, and thus smoked less marijuana in terms of volume. The more recent upward trends did not bode well in that young people are once again reporting getting higher and for a longer time per occasion, indicating that not only were they using marijuana more frequently, they were using more in terms of quantity (assuming some constancy in THC levels over the past decade) (Johnston et al., 1996). More recently, however, we have begun to see some drop in these indicators again (Johnston et al., 2001b).

Particular emphasis is given to frequent users of marijuana because a significant segment of the youthful population has always been involved with marijuana throughout the life of the study. Of course, the recent increases in marijuana use in young people adds even more incentive to focus on frequent users of marijuana. MTF has long been credited with playing a central role in bringing the problem of frequent marijuana use to the attention of policymakers and the general public some years ago, and contributing significantly to subsequent policy initiatives over the past two decades (e.g., Dupont, 1980). This project is in an unusually good position to study large numbers of daily or near-daily users, both cross-sectionally and longitudinally, and will continue to give special emphasis to the phenomenon of daily use. Our

annual monographs, in addition to containing a special section on the respondents' history of daily marijuana use, have documented important changes which have accompanied changes in that behavior—changes in beliefs about the harmfulness of regular use and in personal disapproval of regular use (e.g., Johnston et al., 2001b). These findings have had important implications for prevention, which have been elaborated in Bachman, Johnston, O'Malley, and Humphrey (1988), Bachman, Johnston, and O'Malley (1990a), Bachman et al. (1996), and Johnston (1985, 1991a, 1991b).

Cigarette use, and in particular frequent cigarette use, has been a form of drug use included in the study since its inception, and routinely has been included in all of the annual reports on prevalence rates and trends. After the study's inception, NIDA added tobacco use as one of its mandated areas of research (Jarvik et al., 1977; Krasnegor, 1979a, 1979b). Because of the major health consequences of cigarette smoking, we have continued to give special emphasis to tobacco use, along with related attitudes and beliefs, among the nation's youth (e.g., Johnston, O'Malley, & Bachman, 1999, 2000). Monitoring the Future data on cigarette smoking also have been included in the final reports of the National Commission for Drug-Free Schools and the White House Conference for a Drug-Free America, and also used several times in invited testimony before Congress on legislation aimed at reducing smoking among young people.

Our retrospective data concerning age at first use indicates that the majority of those who are daily smokers in the senior year began daily smoking between eighth and tenth grade, and our eighth and tenth grade surveys have provided additional important information concerning the etiology and correlates of heavy cigarette smoking (e.g., Wynn, Schulenberg, & O'Malley, 1996). By following the 1991-93 eighth grade panels through high school and into young adulthood, we will be able to consider the etiology of heavy smoking in a causal framework. Furthermore, the addition of the age 35, age 40, and the proposed age 45 surveys provides us with the opportunity to examine the longer-term health consequences of early and ongoing heavy cigarette smoking.

In our analytic attempts to differentiate among age, period, and cohort effects in substance use, the one behavior that showed a clear cohort effect was cigarette smoking (O'Malley et al., 1988). We interpreted this as reflecting the persistence of the behavior—once started it is difficult to stop, and therefore any differences between cohorts or classes tend to be long lasting. We also have found cigarette smoking to be unique in another way. Use of other substances, including alcohol, marijuana, and other illicit drugs changed in the first few years after high school graduation as a function of post-high school living environment; substance use generally decreased among those getting married, increased among those who left the parental home but did not get married, and remained essentially unchanged among those who remained in the parental home. Cigarette use was the exception, with smoking rates increasing among all of these groups. Again we interpret this as reflecting the persistence of the behavior, and the difficulty of stopping smoking (Bachman et al., 1984, 1997a, 1997b, 2002; Schulenberg et al., 1994), thus underscoring the need to begin monitoring prior to the likely initiation of daily smoking (see also Chen & Kandel, 1995).

As we discussed earlier under Objective 6a, we recently focused on daily smoking rate changes among high school seniors across two decades (1976-1995), and found that shifts were more likely to occur among seniors classified as "high risk" (based on such risk factors as GPA,

truancy, evenings out, and religious commitment) (An, O'Malley, Schulenberg, Bachman, & Johnston, 1999b). That is, most of the shifting in daily smoking rates over those two decades in the senior year population could be attributed to shifts in rates among adolescents particularly at risk for smoking (and substance use in general). This general "elasticity" in daily cigarette rates among young people at high risk for substance use suggests the importance of targeted interventions (in addition to general population interventions).

One figure that has continued to be highly disturbing throughout the life of the study is the proportion of high school seniors who report occasions of heavy—or binge—drinking: nearly one in three 2000 seniors (about 37 percent of males, 24 percent of females) reported having had five or more drinks in a row on at least one occasion in the two weeks prior to the survey. Furthermore, fully 32 percent of all seniors say that most or all of their friends get drunk at least once a week. The picture is no less disturbing when we look at the rates of binge drinking among the nation's eighth and tenth graders: in 2000, they were one in seven for eighth graders (14 percent for both males and females) and about one in four for tenth graders (30 percent of males, 23 percent of females), indicating a rather sharp increase in binge drinking with age during high school, long before alcohol use is even legal. Moreover, the frequency of binge drinking clearly increases during the first few years after high school. Ironically, the peak levels for this behavior seem to occur at or soon after age 21, when most young Americans first become legally able to purchase alcoholic beverages. (Cohort-sequential analyses make us more confident in interpreting the change as an age-related phenomenon, rather than some period or cohort effect.)

A major reason for concern about heavy drinking is that it is often associated with driving. In order to assess the frequency of driving after drinking, in 1984 questions were added that asked how often the respondents had been driving after drinking and after having had five or more drinks in a row. O'Malley and Johnston (1999) reported results from the surveys of 1984 through 1997. No less than 39 percent of 1984 high school senior males reported driving after drinking in just the two weeks prior to the survey; for females, the figure was 23 percent. And fully 25 percent of all senior males had been driving at least once after having had five or more drinks in a row; an additional 11 percent of females had done so. There was a rather dramatic decline in these figures: in 1990, 24 percent of the males and 14 percent of the females drove after drinking; and 14 percent of the males and 6 percent of the females drove after having five or more drinks. However, there was little further improvement thereafter; and by 1997, the corresponding rates were 22 percent, 16 percent, 16 percent, and 8 percent. These figures remain disquieting; for example, few would take comfort in the fact that nationally *only* 1 in 8 or 9 (11.5 percent) high school seniors in the class of 1997 drove while impaired by alcohol—and likely legally drunk—at least once in the past two weeks. These figures also underscore the need to continue monitoring this area of problem behavior.

We will continue to focus on heavy users in our epidemiological and etiological analyses. With the inclusion of eighth grade panel data we are able to examine further the factors underlying the initiation of frequent and heavy substance use, and with the addition of the middle-adulthood surveys we are able to examine further the longer-term health and lifestyle consequences of earlier and ongoing frequent and heavy substance use.

Objective 9: To continue to study drug use and drug-related attitudes and beliefs among a number of subgroups that historically have been under-represented in drug abuse research. These subgroups include women, ethnic minorities, and young adults who do not attend college, as well as those in military service, civilian employment, or homemaking after high school. (This objective also crosscuts many of the others above.)

Gender. A good proportion of the early large-scale epidemiological studies in this field contained males only, including those by Johnston (1973), O'Donnell et al. (1976), Robins (1974) and a number of others. Beschner and Treasure (1979) made the point more strongly: "In the past, there has been pitifully little research about the extent and etiology of female—youth or adult—drug use." During the 1980s, many more studies focused on drug use and related problems specifically among women (e.g., Beschner, Reed, & Mondara, 1981; Clayton, Voss, Robbins, & Skinner, 1986; Fillmore, 1987; Glynn, Pearson, & Sayers, 1983; Ray & Braude, 1986; Reed, Beschner, & Mondara, 1982; Robbins, 1989; Wilsnack, 1987).

In response to the relative paucity, the U.S. Public Health Service (1985a, 1985b) established a Task Force on Women's Health Issues and published two reports that included various recommendations of the task force. Included in the list of recommendations were special efforts to initiate "Studies of the significant factors related to the onset, continuation, and cessation of smoking, drinking, and drug taking by women" (Ray & Braude, 1986, p. 8). Current PHS guidelines mandate adequate representation of females and ethnic minorities in NIH funded research projects. All of the current major studies on drug use with adolescents and young adults cited in this paper include males and females and often present findings regarding possible gender differences.

Since its inception in 1975, the Monitoring the Future project has surveyed both females and males, and has paid particular attention to gender differences in virtually all of its publications; with the inclusion of eighth and tenth graders in 1991, we have been able to play an even more significant role in understanding the onset of drug use among both genders.

Use of illicit drugs (including, for example, marijuana, LSD, cocaine, heroin, and inhalants) is generally higher among males than females, with the differences emerging with age, so that the differences are greater at twelfth grade than at eighth grade (Johnston, 1993; Johnston et al., 2001b). Prevalence of use of psychotherapeutic drugs (amphetamines and tranquilizers) tends to be about equal or very slightly higher among female students. Use of anabolic steroids is distinctly higher among males at all grade levels; very few female students report using anabolic steroids. Cigarette use is fairly similar between males and females, but smokeless tobacco use is distinctly higher among males. Alcohol use, particularly frequent use, also is distinctly higher among male students (Johnston et al., 2001b).

It should be mentioned here that the Monitoring the Future survey instrument contains a set of questions relevant to women's perceptions of obstacles and opportunities they may face as women, and other questions relevant to their own plans, preferences, and expectations regarding work, marriage, parenthood, childcare, and housework. Thus, not only the male and female members of our samples can be contrasted on all questions in the study, but also females' answers on issues of particular relevance to women can be examined and related to their attitudes and behaviors in the drug domain.

Given that life during adolescence and young adulthood (and beyond) is often structured and experienced differently by gender, we understand the importance of examining similarities and differences across gender. Indeed, in our completed, ongoing, and planned analyses, we routinely consider possible gender differences and interactions. And typically, when we do and do not find differences or interactions by gender, that becomes part of the emphasis of the given paper. Below are some selected examples of such efforts.

Herzog et al. (1987) presented analyses designed to examine some differences in health-threatening behaviors between young men and women, and to explain those differences. We concluded that young men (high school seniors) were more likely than young women to engage in alcohol, drug use, and risky driving, and to become injured by others. We tested a model that posited personal characteristics related to commitment to educational and religious institutions and to the role of genders in this society, and opportunity factors as explanatory factors for the sex differences. Multivariate analyses controlling these factors reduced or eliminated the gender difference in the health-threatening behaviors. Frequency of cigarette smoking, on the other hand, showed no gender difference bivariately, and multivariate controls actually "produced" a gender difference to the disadvantage of young women.

In Bachman et al. (1997a), we presented extensive analyses separately for men and women, highlighting the differences and similarities in terms of the impacts of roles and environments in young adulthood. We reported that most of the impacts were similar for men and women; one notable exception was that pregnancy had substantial impacts on the drug use of women, whereas among men the impacts of having a pregnant spouse are more limited. There were, of course, other important differences in terms of how many men versus women experienced the various roles and environments; for example, men were far more likely to enter military service, women were far more likely to become full-time homemakers.

In a second book (Bachman et al., 2002), we examined the extent to which the impacts of post-high school role statuses and the corresponding new freedoms and responsibilities were mediated through variables such as religiosity, social-recreational activities, and attitudes about drugs. And we investigated the extent to which mediation effects were similar or different for men and women, using multi-group structural equation methods. We found that, for the most part, the effects were generally very similar; one significant difference that emerged was that marriage led to greater decreases in evenings out among men than it did among women.

Young adults who do not attend college. As we noted earlier in the discussion of Objective 6, a major proportion of the studies of young adults of post-high school age have been about college students, who make up less than half of that age group. This focus on college students has occurred primarily because access and data collection can be accomplished much more cost efficiently for those in college than those in other major environments. The dearth of general knowledge about the lives of young adults who do not attend college (i.e., "the forgotten half") was noted as a national concern by the William T. Grant Foundation Commission on Work, Family, and Citizenship (1988).

Monitoring the Future has been able to contribute to our understanding of "the forgotten half," because it contains a large and reasonably good sample of young adults who do not attend college. Because high school dropouts rarely attend college, our original design excluding

dropouts produced noncollege samples that are less representative than the college samples. If approximately 50 percent of the high school graduates attend college, and if dropouts represent around 15 percent of the total age cohort, then dropouts would comprise one-fourth to one-third of the noncollege population (assuming very few dropouts attend college). Nevertheless, some very useful analyses have been, and will continue to be, accomplished with our noncollege samples, for reasons similar to those advanced earlier in discussion of the effect of missing dropouts from the base year samples. In particular, the majority of the noncollege population is covered. Furthermore, observed relationships would be expected to be less affected than point estimates; for example, while the mean level of religiosity might differ, we would expect much less difference in any measures of association between religiosity and other variables. Finally, for our current samples of young adults, trends have remained valid because the relative proportion of dropouts has not changed (assuming that trends are not different for dropouts versus graduates). Because the proportions of males and females attending college have been changing, we have consistently presented data for the college samples separately for males and females (e.g., Johnston et al., 2001b). These changing proportions could lead to trends in drug use that may be somewhat misleading if the sexes were not described separately. For the same reason, we report trends separately for males and females in the noncollege segment. This emphasis on examining similarities and differences as a function of college student experience/college degree (alone and as it interacts with gender) will continue with our considerations of middle adulthood experiences (e.g., Merline et al., submitted).

Racial/ethnic minorities. An important part of our epidemiological and etiological research has been to examine the relationship between race/ethnicity and substance use (Bachman & Wallace, 1991; Bachman et al., 1991d; Johnston et al., 2001b; Wallace & Bachman, 1993; Wallace & Bachman, 1997; Wallace & Bachman, 1991; Wallace & Muroff, in Press; Wallace, 1994; Wallace, 1999a; Wallace, 1999b; Wallace, Bachman, O'Malley, & Johnston, 1995; Wallace, Bachman, O'Malley, Johnston, Schulenberg, & Cooper, in press; Wallace, Bachman, O'Malley, Schulenberg, Cooper, & Johnston, under review; Wallace, Forman, Guthrie, Bachman, O'Malley, & Johnston, 1999). Some of the key questions that we have addressed are: Does the epidemiology of drug use vary significantly across ethnic and racial groups? Are there significant gender differences in drug use among racial and ethnic groups? To what extent are racial/ethnic differences in drug use the result of racial/ethnic differences in sociodemographic and lifestyle factors? Are the risk factors that past research identified as important correlates of drug use among white youth also significant predictors of drug use among minority youth?

One paper (Wallace et al., in press) uses MTF data from white, African American, Mexican American, Cuban American, Puerto Rican, Other Latin American, Asian American and American Indian youth to examine disparities and similarities in their drug use patterns and trends, from 1976 to 2000. This paper is one of the first national studies to disaggregate the nebulous "Hispanic" group into more meaningful ethnic categories (e.g., Mexican, Puerto Rican, Cuban). Also, this paper provides both the longest and the most up-to-date data on trends in adolescent drug use among these many racial/ethnic subgroups.

In another paper, Wallace and Muroff examined the extent to which white and African American adolescents are or are not differentially exposed and/or vulnerable to key risk factors for drug abuse that have been identified in past research. Although past research has examined,

at least to some extent, the notion that black and white adolescents are differentially exposed to key risk factors for substance use, this is one of the first, and the largest study to examine not only differential exposure but also differential vulnerability as key explanatory factors for racial differences in adolescent drug use.

We have also been concerned about possible differential validity of reporting by different race and ethnic groups, and have investigated whether differential validity of self-reports might account for observed differences. Fortunately, the data appear to show very convincingly that differential validity is not likely a major ingredient in the different usage rates that we have reported (Wallace & Bachman, 1997).

Military, civilian employment, and homemakers. We included in follow-up surveys members of the military and civilian populations and those who were homemakers. All of these groups were included in the analyses reported in two recent books (Bachman et al., 1997a, 2002), and discussed under Objective 6, above. Another analysis (Bachman et al., 1999b) focused on young adults who entered military service by modal ages 19 or 20 (first follow-up), and contrasted them with those who entered college or civilian employment. The overall analyses contrasted men and women; however, detailed analyses showing impacts of historical changes in military policies about drugs could be carried out only for men, because the samples of women enlistees were too small for these analyses. These and various other analyses were supported, in large measure, by outside funding under a grant to Bachman from the Army Research Institute and the Office of the Secretary of Defense.

Objective 10: To continue to make methodological, substantive, and policy-relevant contributions to the larger fields of social, behavioral, educational, and medical research dealing with drugs and/or youth.

Under this broad objective, there are four varied sub-objectives, listed and discussed separately below.

Objective 10a: To refine methodologies for the analysis and interpretation of self-report measures of drug use, including documenting the reliability and validity of such measures.

Stability and reliability. In the early years of the study the longitudinal component of Monitoring the Future allowed us to estimate the reliability and stability of self-reports of drug use in a national sample over relatively long periods of up to four years (O'Malley, Bachman, & Johnston, 1983). Heise (1969) showed that reliability (defined as the proportion of variance in the observed score that is due to the true score) and stability (defined as the correlation between two true scores measured at two different times) could be separated, given at least three different measurement points, if one is willing to assume that the reliability of the measuring instrument is equal at all three times. Wiley and Wiley (1970) suggested that another assumption, often more appropriate than constant reliability, was one of a constant amount of error variance. In both procedures, error scores are assumed uncorrelated over time. Using the LISREL computer program (Joreskog, 1979) to implement the Wiley and Wiley procedures, we obtained results indicating that the measures of current cigarette use, annual alcohol use, and annual marijuana use all had reliabilities of .84 or higher. An index of the use of illicit drugs other than marijuana

was somewhat less reliably measured—though still sufficiently reliable for survey purposes—with estimates based on different samples ranging from .70 to .87. Estimated stabilities were quite high: the highest annual stability (that is, the estimated correlation between two true scores measured one year apart) was for current cigarette use, at .92 or .93. The other stability estimates were slightly lower, about .87 for 30-day use of alcohol, and .89 for annual alcohol use and annual and 30-day use of marijuana. The use of illicit drugs other than marijuana was less stable (though still quite stable), with annual use stability estimated at .85 and 30-day use stability estimated at .79. It turned out to make little difference whether one assumed equal reliabilities or equal error variances: estimated reliabilities and stabilities were very similar under the two assumptions.

More recent efforts have utilized data from senior year plus up to seven follow-ups every two years after graduation, for a total of eight measurement occasions, which allows one to make fewer assumptions (Bachman et al., 1997a, 2002). For these analyses, using the EQS program, we assume only that the error variances at the first two measurement occasions are equal, and that the error variances at the last two are equal. (The problem is that the "outside" error variances—that is, the first and last—are unidentified without some identifying assumptions.) No other equality assumptions were needed. Monthly cigarette use shows the highest average annual stability (.97), followed by annual marijuana use (.95), monthly alcohol use (.94), and heavy drinking in the last two weeks (.94). Annual cocaine use is somewhat less stable (.91). Stabilities across the eight measurement periods are higher than the earlier estimates; this is undoubtedly due to the greater volatility in drug use in the first few years after high school. In terms of reliability, the 30-day measure of cigarette use shows the highest value, with an average reliability of .86. Annual marijuana use is also highly reliably measured (.84). Monthly alcohol (.71) and annual cocaine use (.68) are somewhat lower, and heavy drinking during the prior two weeks is lowest (.64), as might be expected, given the short time sample.

Another look at reliability of drug use reporting was provided by Johnston & O'Malley (1997). These analyses of panel data from young adults investigated the extent to which respondents were consistent in their self-reported lifetime prevalence of drug use over multiple measurements. Overall, recanting rates were found to be modest for the illegal drugs but less so for the psychotherapeutic drugs. In general, differences in recanting rates among subgroups were not large. Among the largest were: (a) the rates for African Americans recanting earlier reported marijuana and cocaine use (but not the use of three other drugs), and (b) rates for those young adults who are in the military or in police or firefighting occupations.

We believe that these findings advance the state of knowledge about the use of self-report instruments in this field as well as about the relatively high degree of stability that is found in drug use patterns from the late teens and through the early 30s.

Validity. One concern raised has been whether respondents can report accurately about their substance use over longer time intervals (Radosevich et al., 1979). We have done a careful comparison of drug use rates as reported for the last 30 days compared to the last 12 months, and discovered a rather interesting and important discrepancy. Specifically, either the annual frequencies are too low, the monthly frequencies are too high, or both. In analyzing the discrepancy, which is fairly large and quite consistent across different drugs, we considered four possible explanations: forgetting, telescoping (remembering events as occurring more recently

in time than they actually did), developmental trend (more drug use later in a year as a function of age), and "senioritis" (more drug use in the late stages of the senior year as part of the "rites of passage"). The most appropriate conclusion from these analyses seems to be that simple forgetting probably accounts for most of the discrepancy. This implies that the frequency of drug use during the past year, and probably also lifetime, are in many cases systematically underestimated.

We also investigated three other possibilities related to the 30-day versus 12-month discrepancy. If, for example, some respondents are especially likely to forget or to repress some amount of their drug use over the course of the preceding year, then certain patterns of relationships among various discrepancy ratios should be evident: (1) Discrepancy ratios for a given drug should show some degree of positive correlation across time; that is, they should exhibit stability. (2) Within a particular time interval, discrepancy ratios for one drug should correlate with discrepancy ratios for other drugs. (3) Discrepancy ratios should be correlated with other individual characteristics such as reading or verbal ability. We examined base year and follow-up data for several different classes for various longitudinal intervals. To summarize the findings briefly, there was no evidence of systematic cross-time longitudinal associations in discrepancy ratios for the various drugs, but there was considerable within-time association among drugs. The discrepancy ratios were not related to stable individual characteristics.

We conclude from these various analyses that the underestimation of 12-month use is not a serious problem for this study for several reasons. First, it is quite likely that a respondent will remember having used a particular drug at least once, even though the number of times beyond one or two may be less clearly recalled; therefore, there should be little recall error in period prevalence estimates. Further, there is no reason to suppose that the pattern of inconsistency will change from one year to another, and therefore analyses of trends will likely be valid since the biases will be fairly constant from one year to the next. Finally, the tendency to be inconsistent, and presumably to underreport annual use, is not strongly associated with any of a broad array of individual characteristics (Bachman & O'Malley, 1981; O'Malley, Bachman, & Johnston, 1983).

There are various other types of evidence bearing on the validity of self-report data and such data dealing specifically with substance use, which are summarized in the annual volumes of epidemiological results (Johnston et al., 2001b). The reader is referred to that source for a discussion of the evidence.

One particular question regarding the validity of drug surveys is whether there are racial or ethnic differences in the tendency to report drug use validly (Mensch & Kandel, 1988b). Wallace and Bachman (1993) provided a series of analyses that investigated whether minority students under-reported their drug use. These analyses indicate that, although caution should be used when reporting and interpreting racial differences in school-based survey responses, particularly when such differences are relatively small, the large racial and ethnic subgroup differences in self-reported drug use found in the MTF data are likely to be valid and reliable. A chapter by Wallace, Bachman, O'Malley, and Johnston (1995) further discussed issues about the validity of self-report data in student-based studies with minority populations. These analyses utilized data from the eighth, tenth, and twelfth grade surveys, and the analyses again supported the general validity of such data. That chapter points out that some of the differences in drug use between white and Hispanic high school seniors can be explained by the higher drop-out rates

among Hispanic youth. But none of the several hypotheses investigated seemed to account for the different rates of use between white and African American youth.

Representativeness. One issue relating to the representativeness of the Monitoring the Future sample—an issue that is of concern to many other researchers as well—is the effect of absentees. Kandel (1975), Josephson and Rosen (1978), and Johnston, O'Malley, and Bachman (1996) have shown absenteeism is correlated with drug use. We examined the effect of differential weighting of data to adjust for the rate of absenteeism, and we concluded that the adjustment had minimal effects on prevalence and trend estimates and thus was not worth the cost and difficulty of differential weighting (Johnston & O'Malley, 1985).

The issues discussed above are examples of the types of methodological contributions to the field that constitute a by-product of the extensive analyses being done on the project.

A number of the techniques used to test for reliability and validity of the Monitoring the Future data have now been extended to data gathered in several European countries, using an instrument modeled after ours (Johnston, Driessen, & Kokkevi, 1994). The results of this work, sponsored by the Council of Europe, suggest that there is considerable evidence of reliability and validity in these instruments, even when applied to a range of different cultures and age groups. The generality of reliability and validity clearly facilitates international comparisons.

Objective 10b: To continue to provide measures for, and to stimulate the comparability of measurement in, drug research, at the sub-national, national, and international levels; and to provide national norms for comparison purposes.

The meteoric rise in drug use in the United States during the late 1960s and early 1970s was closely followed by a similar rise in survey studies of young people—many in specific schools and colleges (Berg & Broecker, 1972). These many surveys were conducted using an almost equal number of research instruments, often resulting in use of poor or unworkable instruments and frustrated attempts to compare or integrate findings across studies. In 1974 NIDA and the Special Action Office on Drug Abuse Prevention gave official recognition to this problem by establishing a committee of research scientists to recommend some standardized measurement techniques and terms. The committee developed recommendations (Elinson & Nurco, 1975); and subsequently, a *Drug Abuse Instrument Handbook* was developed (Nehemkis, Macari, & Lettieri, 1976). A second NIDA committee was later created to review the standardization of interview measures (Rittenhouse, 1978).

The first committee and the subsequent handbook recommended certain standard characteristics for drug use measures (Kandel, 1978a, pp. 28-30) that would be compatible both with certain earlier studies and with the Monitoring the Future series. A third committee met to develop a handbook devoted to helping investigators interested in assessing marijuana use consequences (Huba, Bentler, & Newcomb, 1981a); it adopted a number of Monitoring the Future measures, and Monitoring the Future also adopted some of the new measures developed by the committee.

Since that time, we have made an active effort to stimulate the use of compatible measures by other researchers in this country and abroad. This has been done both by offering

the use of Monitoring the Future measures in other studies for which they would be appropriate, and by suggesting the incorporation of compatible distinctions in measures developed for different formats.

To date we have made various parts of our measurement package available to all who have expressed an interest in using them. In this country, a number of sizable surveys have made use of portions of the instrumentation. The National Household Survey of Drug Abuse (SAMHSA, 1999), the adolescent smoking segment of the National Health and Nutrition Examination Survey (National Center for Health Statistics [NCES]), an AMA-sponsored survey of medical students (Baldwin, Hughes, Conard, Storr, & Sheehan, 1991), the Centers for Disease Control's Youth Risk Behavior Surveillance study, and a survey of college student athletes by the National Collegiate Athletic Association (Anderson, Albrecht, McKeag, Hough, & McGrew, 1991) are some of the national efforts that have used Monitoring the Future items. At a minimum,[11] state-wide surveys in Colorado, Connecticut, Indiana, Massachusetts, Michigan, Minnesota, Nebraska, New Jersey, New Mexico, New York, and Oregon have utilized portions of our instrumentation. In addition, use of our questionnaires has been requested by many American investigators conducting their own surveys.

On the international level, model instruments have been developed with our participation by both the World Health Organization (WHO) (Smart, 1980) and the United Nations Division of Narcotic Drugs (UNDND) (1980). The WHO instrument, a self-administered questionnaire, was developed and applied to purposive school samples in seven countries. It was then revised and has been disseminated as a model for investigators in other countries wishing to conduct school-based studies. While simplified for use with populations in developing, as well as developed countries, it has a basic structure (in the distinctions among drug classes, in time intervals for prevalence measurement, and in frequency distinctions) that will generate data comparable to data from Monitoring the Future. It also contains a number of optional segments on attitudes, availability, and so on, which are based directly on Monitoring the Future measures. Another WHO instrument, which is similarly compatible, was also developed.

A model interview schedule for drug use surveys in developing countries was developed by Johnston under United Nations sponsorship (United Nations Division of Narcotic Drugs, 1980). It was designed to be compatible with the WHO instruments, the Monitoring the Future instruments, and portions of the NIDA Household Survey instruments.

A multi-country school drug use survey study, mentioned briefly in Objective 10a, has been conducted under the auspices of the Council of Europe. Johnston served as coordinating investigator, and the instrument package consisted almost entirely of Monitoring the Future instrumentation (Johnston, Driessen, & Kokkevi, 1994). A critical outgrowth of that activity was a 26-country coordinated school survey in 1995 of nationally representative samples of students, mostly in Europe, using an instrument based largely on the pilot study instrument just mentioned. (Johnston served as a consultant in the design, instrumentation, and reporting of the 26-country study.) The work, which was sponsored by the Swedish government in collaboration with the Council of Europe (Hibbell & Andersson, 1996), was repeated in 1999, with 30 European

[11]We are not always aware of the extent to which some use is made of the Monitoring the Future instrumentation.

countries participating (Hibell et al., 2000). Thus, this effort constitutes a major expansion of the field of drug epidemiology at the world level.

Monitoring the Future is also contributing to the advancement of epidemiological work at the international level, and specifically to the standardization of instrumentation, through Johnston's participation in the development of a new manual entitled *Guide to Drug Abuse Epidemiology* published by the World Health Organization (WHO) as an international guide. He contributed two chapters (Johnston, 2000a, b), and many MTF variables and measures are included as models.

We have also provided copies of our instruments to a number of Canadian, Australian, African, Asian, and European investigators at their request; and they have been adopted in a number of national assessments overseas.

We consider these to be major steps toward the standardization of measurement in the field. We expect that Monitoring the Future can continue to play an important role in this effort, not only by making its instrumentation available, but by providing up-to-date national norms against which the results of studies on more local or specialized populations can be compared. Such comparisons may well contribute to improved understanding of the role that various cultural and social factors play in the etiology of drug use.

Objective 10c: To continue to conduct research of policy importance, particularly the evaluation of "natural experiments" that can build upon the main study with great economies in cost and time; and to facilitate the use of MTF data for policy studies by and with external collaborators, who often combine MTF data with other relevant data sets.

Because we have accumulated large numbers of respondents in nationally representative samples, there is now a rich resource that can be used to address many research and policy issues not encompassed in the current design. We discuss below several types of research potentials that are provided by the existence of the Monitoring the Future project.

Evaluating natural experiments. One important example to date has been our ability to address the question of the behavioral impact of marijuana decriminalization. Having before and after data in a number of "control," as well as "experimental," states allowed us to address in a prospective fashion the question of impact under a separate grant from the National Institute on Drug Abuse (Johnston, O'Malley, & Bachman, 1981). Had the main study not been in place, it is doubtful that there would have been sufficient time to mount a comparable effort; but, even if there had been time, the cost would have been far greater.

A second example of an evaluation of a natural experiment also relates to evaluating a change in the legal status of use of a drug, in this case, alcohol. A number of states lowered the minimum age for purchase of alcohol in the early and mid-1970s. Following increases in the rate of driving accidents after drinking by young people, several states raised their minimum drinking ages in the late 1970s and early 1980s; and, by 1987, national legislation had prompted all other states with a minimum drinking age less than 21 to raise that minimum to 21. Thus, because we had before and after data in a number of states, we were in a position to evaluate the likely effect of these law changes. The National Institute on Alcohol Abuse and Alcoholism provided funds

to perform such an evaluation, and the results were reported by O'Malley and Wagenaar (1991). A later similar effort evaluated the effects of changes by many states in the blood alcohol concentration levels that determined "driving under the influence" status (Wagenaar, O'Malley, & LaFond, 2001). In this case, additional funding was provided by the Robert Wood Johnson Foundation.

Because the legal status of drug use (including alcohol and cigarette availability) remains in a state of flux, it seems likely that other natural experiments will be taking place. Cigarette smoking is being regulated in a variety of ways, including the proposed removal of machine-dispensed cigarettes, which may make cigarettes less available to youngsters. Taxation of alcohol and tobacco products is another example of policy decisions that could influence use of those substances. Several efforts have already utilized Monitoring the Future data to evaluate the effects of prices on cigarette use among adolescents (Chaloupka & Pacula, 1998; Gruber & Zinman, 2001; Tauras, O'Malley, & Johnston, 2001). As such events occur, the Monitoring the Future data series can be used to assess their effects on young people. In some cases this may mean gathering some supplementary data, as in the study of marijuana decriminalization; but in other cases existing data may suffice.

Evaluating planned experiments. While natural experiments provide one type of experimental manipulation that may be assessed using the existing monitoring system, planned experiments provide another—that is, true experiments planned with the evaluation system and control groups in mind. For example, educational and persuasion efforts aimed at reducing the abuse of drugs might be introduced in selected experimental schools (if conducted through the school) or regions (if conducted through the media). The existing national series could be used to provide control data on use, attitudes, beliefs, and so on, while presumably supplementary data collections could be made in those areas where the experimental intervention was introduced. We have argued elsewhere (Johnston, 1977) that planned experimentation with carefully thought-out evaluation provides the most promising route for the advancement of intervention techniques in the drug abuse field. We are prepared to contribute to the process by making intervention and comparison data available to others and, if necessary, by proposing to conduct supplementary data collections or analyses ourselves. One such effort is now underway, in fact, involving a supplementary sample of about 50 schools in which Botvin's Life Skills Training (LST) is in the process of being adopted. Under funding from the Robert Wood Johnson Foundation, we are attempting to evaluate the effectiveness of this program as it diffuses throughout the country. We will be assessing the changes in levels of various types of substance use among eighth graders in the schools adopting this program, and comparing them to the changes observed in the MTF schools not adopting that program. The results could have significant implications for schools and the prevention field.

One planned intervention, which generally was not implemented within an experimental design, is the massive national effort by the Partnership for a Drug-Free America (PDFA) to discourage drug use via the media. The Monitoring the Future study has contributed trend data on use, as well as attitudes, and has done much to establish the importance of certain attitudes and beliefs. In addition, a number of questions were added to the study to secure the respondents' assessment of the qualities and impact of this advertising campaign and the results have been encouraging (Johnston, 1999b). Results have been shared over the years with PDFA and ONDCP, and presented in testimony before the Congress (Johnston, 1999b). Thus the study

has been of acknowledged value to this important undertaking, but it has not provided an experimental design.

Extended study of select subgroups. Rather than focusing on a representative cross-section of a graduating class, there may be occasions where extended study of a highly select subgroup is desired. For example, Smith et al. (1977) noted that screening surveys provide one method of securing heavy marijuana users in the normal population for possible extended study of the physiological and psychological effects of their use. Mounting large-scale surveys expressly for such a purpose could be extremely expensive; however, Monitoring the Future contains measures of drug use and has the capacity to relocate respondents, and thus could be used as a screening survey at very modest cost. For example, we responded affirmatively when one investigator in the field asked our assistance in selecting a sample of monozygotic twins. While his research was never launched, the potential was there. Of course, continued study of the groups selected is not without its potential problems. Certainly their explicit consent to participate in a different research undertaking would be required and, insofar as group membership denoted an illegal behavior, effective procedures to protect their identities would be needed.

Since the major alternatives to using screening surveys tend to yield either samples for which representativeness is suspect (e.g., people referred to treatment or counseling agencies) or samples with too few users of many of the drugs to justify intensive study (e.g., household surveys), the use of a representative large-sample survey of the normal population seems particularly attractive for locating specialized segments. Heavy marijuana users, of course, constitute only one example, albeit a particularly germane one. Users or, more likely, heavy users of other classes of drugs (e.g., cocaine) or particular drugs or drug forms (e.g., crack) could be identified in a parallel way, as could appropriate control groups. Similarly, certain "at risk" populations, identified using known predictors of certain behaviors or other outcomes, might be sampled using either recent or older cohorts. Certainly the use of older cohorts permits a quick telescoping of time, which for some research purposes may be a critical consideration.

Other research potentials. MTF, by virtue of its sampling frames and new and ongoing panels, represents a rich resource that has been and will continue to be used to investigate key policy issues concerning important sub-populations. Some of these efforts may be within the domain of substance use (e.g., see Johnston, O'Malley, & Davis-Sacks, 1983; Johnston, O'Malley, & Harrison, 1989); other times these efforts may be outside the domain of substance use (e.g., see Bachman, Segal, Freedman-Doan, & O'Malley, 1998; Herzog & Bachman, 1982; Rodgers & Bachman, 1988.

Objective 10d: To continue to provide measures of progress toward the accomplishment of various national goals, including the National Education Goals, the National Health Goals, the President's National Drug Control Strategy goals, the DHHS reports on child well-being, the Surgeon General's Reports on Smoking, and the Surgeon General's Reports on Adolescent Violence.

Monitoring the Future has been used as a data source for measuring the accomplishment of various national goals included in the White House's annual National Strategy on Drug Abuse; DHHS's Health Objectives for the Year 2000; and the National Education Goals Panel's

Objectives for the Year 2000. In addition, the final report of the National Commission on Drug-Free Schools (1990) relied heavily on results from Monitoring the Future; and the annual Sourcebook of Criminal Justice Statistics, which tracks crime and victimization in the country, contains a substantial amount of data from the study. Among the government's Health Objectives for the Year 2000 were a number of dimensions for which Monitoring the Future was the source of information. Similarly, the National Education Goals relies primarily on data from the Monitoring the Future project to measure at the national level the accomplishment of the seventh of the eight educational goals: "Safe, disciplined, and drug- and alcohol-free schools."[12] We believe this constitutes formal recognition of the importance of the study's many indicators to the monitoring of the well-being of the young people in America.

Objective 11: To continue to facilitate the use of the MTF databases by others—including investigators in a variety of substantive and disciplinary fields—while adequately protecting the confidentiality of the study's many respondents.

We believe it desirable to make the data, as well as the instrumentation from this study, readily available to the larger field of scholars. There are several reasons for this view. First, on issues having the social importance of some of the ones we have been addressing, we believe it important for others to be able to check, and perhaps at times challenge, our conclusions by conducting their own analyses. Second, the complex design of the study, combined with its great breadth of substance, means that a data resource results that is far too rich for a single set of investigators to exploit completely. We believe that many investigators within and outside of the drug field will have questions to ask of the data that we will not be able to pursue ourselves.

Throughout the life of the study we have made the data available primarily through two mechanisms, a national data archive and our data resource volumes. The eighth, tenth, and twelfth grade cross-sectional data sets from the Monitoring the Future study are provided on an annual basis to the Substance Abuse and Mental Health Data Archive (SAMHDA; http://www.icpsr.umich.edu/SAMHDA/), which is a part of the Inter-university Consortium for Political and Social Research (ICPSR) and is located at the Institute for Social Research in Ann Arbor. SAMHDA, in turn, processes these data sets and makes them available in a standard format on the World Wide Web to anyone who requests them. SAMHDA currently provides access to more than 170 different MTF cross-sectional data sets. SAMHDA also makes available a Web-based data analysis capability for a number of MTF data sets that contain key multi-form "core" variables (http://www.icpsr.umich.edu/SAMHDA/sda.html). ICPSR is particularly well-suited for these archival activities, because it has established dissemination capabilities with some 300 colleges and universities throughout the nation and the world and is the world's largest social science data archive.

The second major medium for dissemination of information to other researchers and policy makers is our series of annual reference volumes containing summary statistics from the surveys of twelfth graders. Twenty-six (1975-2000) of these have been published as of this

[12]We worked extensively with the National Education Goals Panel in the formulation of measures for this objective, including the development of some new measures on weapons at school, feeling safe at school, and disruptions in class—all of which were added to MTF to assist the work of the Panel.

writing. They contain percentagized univariate and bivariate distributions for all variables measured on each year's senior class—nearly 2000 variables in all. Bivariate statistics for subgroups defined by gender, race, region of the country, college plans, and a composite index of drug use are included routinely. Trends across time for all seniors, or for any of these subgroups, can be determined by using the reference volumes for two or more years in combination. In addition to serving as reference works in their own right, we believe they can serve to stimulate and facilitate use of the archived data. Not only can the volumes serve to stimulate interest by calling attention to the existence of particular variables, and perhaps to some intriguing preliminary findings, but they can also serve as codebooks for the user of the public data sets and provide a standard set of univariate and bivariate statistics on all analytical variables. Further, they can provide national norms for any investigator using some of our measures to survey particular populations of special interest.

Three other publication series are also worth brief mention in this regard—our own annual volumes of detailed results on the various drugs, published by NIDA (Johnston et al., 2001b, c), a DHHS series—the most recent being *Trends in the Well-Being of America's Children and Youth*, 1999; and the Sourcebook of Criminal Justice Statistics, published by the Department of Justice (Bureau of Justice Statistics, 2000; also available online at http://www.albany.edu/sourcebook). The latter, an important sourcebook series in the criminology field, regularly carries a sizable section (now roughly 40 pages) of data in trend tables derived from our annual volumes of descriptive data.

In addition to these public data resources, we also have made other data available to individual researchers on request. Because of major concerns about protecting the confidentiality of our many respondents, we concluded that it constituted an unreasonable risk (and thus a breach of our assurances to respondents) to place the study's panel data into public access archives. We believe that there would be a very real potential for someone to break confidentiality through the "pattern identification" of individuals using the extensive panel information and that, because these files contain a considerable amount of highly sensitive data, it would present too great a challenge or opportunity for someone to misuse them. (An important implication of our design, which involves the inclusion of whole schools at a given grade level, is that a large number of people know that any given individual participated in this study. To illustrate the risk, we have had at least one request for data on a respondent from a spouse in a divorce proceeding.)

However, we recognize the desirability of providing analytic access to the panel data to other investigators, and we have used a number of different mechanisms to do so. The most important mechanism was to add to the project staff a data analyst (who has two Master's degrees in statistics and mathematics) who is available to outside users to run analyses on the panel data or to provide a summary data set, for example, a covariance matrix. (This arrangement, implemented in 1994, is analogous in many ways to what the MTF investigators themselves do to carry out analyses.) At the specification of the outside investigator, the analyst conducts analyses on an actual-cost basis and provides the results in an appropriate form to the investigator. While this process may be more cumbersome than having a public-use panel data set, we concluded that it was the most forthcoming arrangement we could justify and still meet our obligation to our respondents to protect their identities.

We have also instituted a Remote Analysis System (RAS), available through the Internet. An outside investigator can conduct analyses on a "dummy" data set, and then provide the analysis commands (using SAS, SPSS, SUDAAN, etc.) to the MTF staff, who run the specified analyses on the actual data.

In sum, we have used, and will continue to use, a variety of mechanisms to provide data for others to utilize, and we believe we have been successful both in preserving and protecting the confidentiality of our respondents, and in accommodating the needs and wishes of other researchers who require access to data that cannot be made publicly available.

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